GRANT AGREEMENT N. 871245

Deliverable D1.6

User feedback from the final validation (relevant environments)

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APPROVALS

Authors/editors	Maribel Pino (AP-HP) Sébastien Dacunha (AP-HP) Anne-Sophie Rigaud (AP-HP) Lauriane Blavette (AP-HP) Florian Gras (ERM)
Task Leader	ERM
WP Leader	ERM

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Executive summary

Deliverable D1.6 presents the results of experiments conducted by AP-HP in a real environment. Different versions of the SPRING system were assessed with its respective modules integrated (ERM).

The experiments were held at the Day Care Hospital of Broca Hospital (AP-HP) where patients, accompanying persons and healthcare professionals were recruited to participate in the experiments.

The document contains four sections:

1. Description of the general framework of the SPRING project experiments in a realistic environment
2. Description of the evaluation environment and research procedures
3. Description of the methodology and results of three waves of evaluations
4. General discussion and conclusion of the assessments

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1. General framework for the SPRING project assessments

Within the framework of the SPRING project, five use cases for a socially assistive robot in a hospital context were developed.

a) The robot provides a reception or welcoming of the hospital users
b) The robot delivers information and reminders on how to have safe social interactions
c) The robot provides assistance to patients throughout the care process
d) The robot provides orientation and guidance related to the hospital services
e) The robot provides entertainment activities for persons who attend the hospital

With the aim of assessing the relevance and effectiveness of these use cases, we conducted throughout the project experimental research involving human subjects. These assessments were done in both, relevant (simulated) and realistic environments (day-care hospital). Two experimental frameworks were therefore defined to meet the needs of the project (Figure 1).

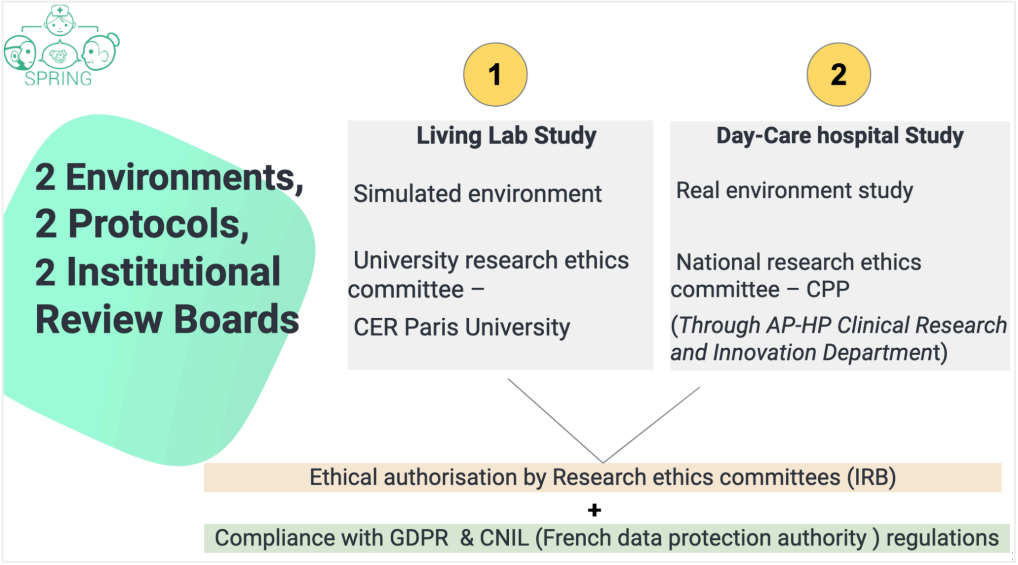

Figure 1. Global description of the experimental assessment for the SPRING project

This report details the **final results of experiments** conducted between March 2023 and May 2024 as part of the SPRING project in a realistic environment (Day Care Hospital). These final experiments allowed for the evaluation of the integrated robot modules under real conditions, with iterative assessments ensuring thorough testing and refinement. Three waves of assessment were conducted, with the first taking place from may to july, the second from september to december, and the third from march to may. The results of each of these assessment waves are presented individually in this report.

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2. Description of the evaluation environment and research procedures

2.1 Description of the environment

The Broca Hospital (AP-HP) is a geriatric day care hospital, specialising in the provision of personalized care and support for older people with physical or cognitive impairments. As such, the Broca Day care Hospital offers a range of geriatric consultations, covering areas such as neurology, oncology, cardiology, behavioural/psychiatric disorders, memory consultations and many others. Its multidisciplinary medical team is specially trained to meet the complex and varied needs of elderly patients, with an emphasis on holistic and personalised care.

The premises of the day care hospital include several services and areas for the reception of patients and accompanying persons, a waiting room, a secretary's office, consulting rooms, a dining room, and toilets (see Figure 2). The SPRING experiments took place in the day care hospital's dining room, a space strategically chosen for its proximity to the main waiting room.

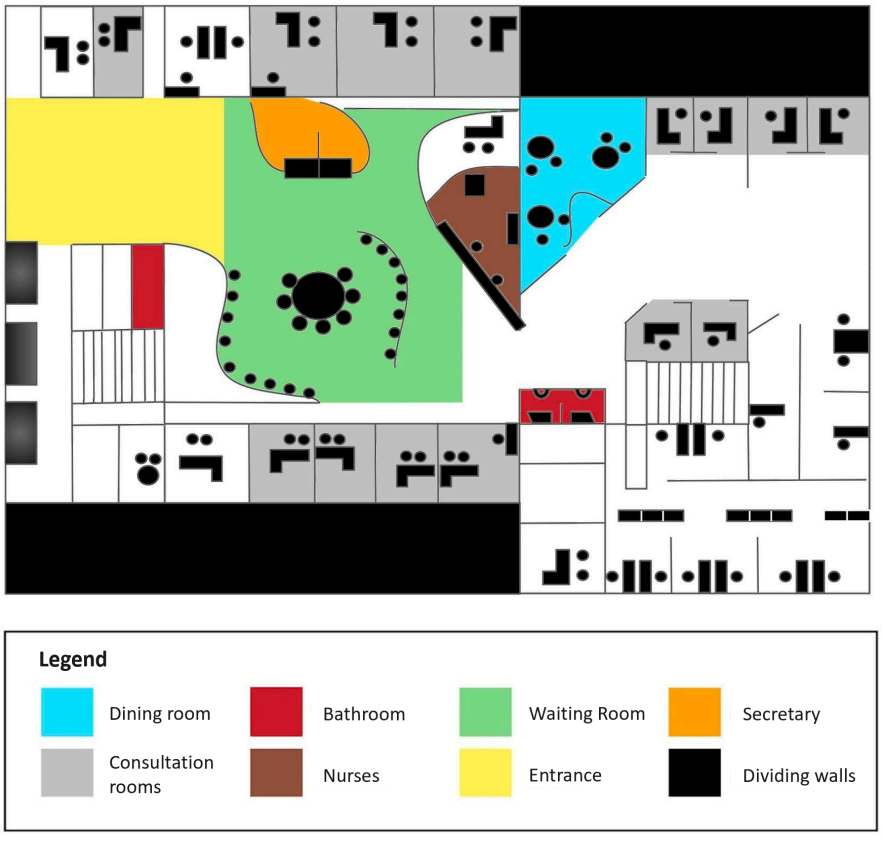


Figure 2. Sketch of the surroundings of the Day Care Hospital

By using this central and easily accessible space, we ensured that participants could easily get to the experiments while minimising disruption to the daily flow of the hospital and their clinical appointments. The dining room is also used as a rest area for patients wishing to wait in a quieter environment. This space is equipped with refreshments, a water fountain, and a television, offering a comfortable and welcoming environment for those waiting between medical appointments.

Figures 3 and 4. Waiting room (left) and dining room (right) of the Day Care Hospital of Broca Hospital.

2.2 Study with older adults and accompanying persons (Geriatric Day Care Hospital - realistic environment)

Objectives

The primary objective of this study was to evaluate the performance, acceptability, and usability of the SPRING robot among a sample of users (patients and accompanying persons) within a real-life environment (Geriatric Day Care Hospital). The secondary objective was to identify ethical issues associated with the deployment of socially assistive robots in healthcare settings.

Based on the results of this study, we will determine the potential for socially assistive robotics to enhance patient care quality and support healthcare professionals' work in the hospital. Furthermore, these results will inform the drafting of recommendations for future improvements to the solution and its implementation in other similar environments, ensuring broader applicability and impact.

Participants

Eligible individuals, comprising patients of the geriatric service and their accompanying persons, were those who wished to participate in the study. They had to express no objection to participation and meet the inclusion criteria defined below.

Group 1: Older adults - patients

- Patients attending one of the Broca Day Care Hospital consultations
- Being over 65 years old
- Have a sufficient understanding of French
- Without distinction of gender, socio-professional category or ethnic origin
- Without severe cognitive disorders (MMSE[1] > 10) or symptoms of reality alteration (delirium, hallucination)
- Having expressed no opposition to participate in the study

Group 2: Accompanying persons

- Accompanying family members or friends (informal caregivers). Primarily spouses (older adults) or children of patients, also family friends or neighbours
- Being over 18 years old
- Have expressed non-opposition to participating in the study

General procedure of the tests

After being informed about the assessment procedure and signing the written consent to participate in the assessment session:

- Participants were invited to a specific room in the Day Care Hospital for 30-40 minutes.
- Both individual and patient-companion interactions were organized to test the robot and conduct predefined assessments.
- Participants were invited to interact with the robot and test a predefined use case.
- The test sessions were video recorded for subsequent analysis to ensure thorough evaluation and documentation of the research findings.
- At the conclusion of the interaction with the robot, each participant individually completed questionnaires employing a mixed, quantitative approach with standardized scales. Subsequently, each participant participated in a separate interview conducted by two researchers from the APHP team.

Assessment instruments

(a) Usability: " System Usability Scale" (Bangor et al., 2008; Brooke, 1996). This is a 10-item questionnaire reliable - for measuring usability. *Usability* has been defined as the ease of use and acceptability of a system or product for a particular class of users carrying out specific tasks in a specific environment; where 'ease of use' affects user performance and satisfaction, and 'acceptability' affects whether or not the product is used (Bevana et al., 1991).

[1] The Mental-State Examination (MMSE) is a commonly used set of questions for screening cognitive function that can be used to indicate the presence of cognitive impairment. Scores of 25-30 out of 30 are considered normal, 21-24 as mild, 10-20 as moderate and below 10 as severe impairment.

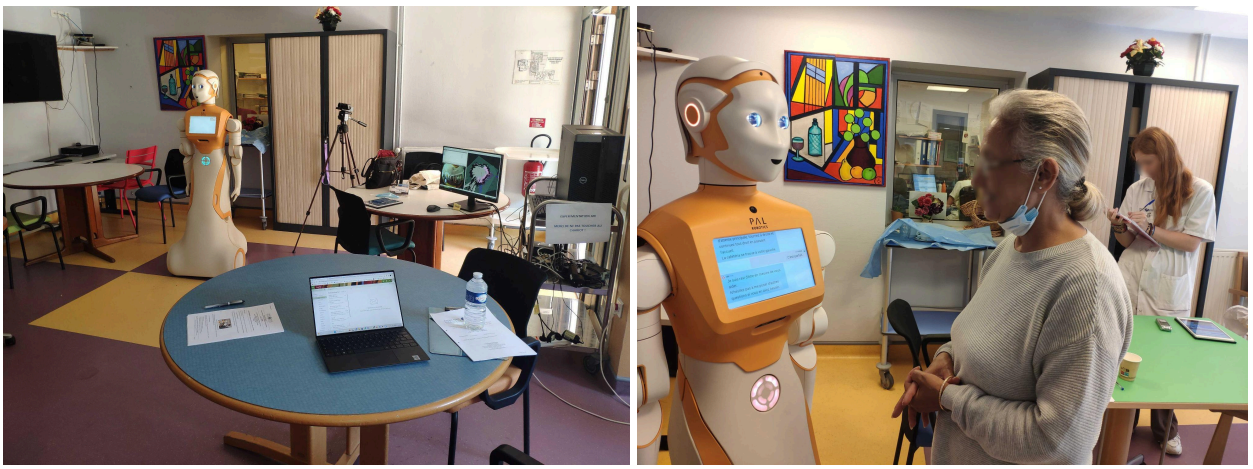
The SUS instrument offers several advantages: it is straightforward to administer, yields reliable results even with small sample sizes, and effectively distinguishes between usable and unusable systems. The SUS score ranges from 0 to 100, with scores above 68 considered above average and those below 68 deemed below average. Adjective ratings provide further interpretation of the SUS score. The scale is available in Annex 2.

(b) Acceptability: The "Acceptability E-Scale" (AES), French version (Micoulaud-Franchi et al., 2016), has been adapted for application with a robot (refer to Annex 3). Acceptability is defined as the psychological antecedents influencing the behavioral intention to use technology without prior system experience. The AES is a 6-item self-reported questionnaire designed to assess the extent to which users perceive a system as acceptable, focusing on two key dimensions: usability and satisfaction (Hayotte et al., 2020).

(d) Ethical aspects: Semi-structured interviews, based on existing ethical questionnaires (Alaiad & Zhou, 2014) and the "Ethical Acceptability Scale" (Peca, 2016), were utilized to explore general ethical issues related to the use of social and assistive robots in healthcare environments. These interviews aimed to assess the perceived advantages, disadvantages, and risks of such technologies as viewed by potential users (see Annex 4).

Data analysis conducted

To achieve a holistic understanding of the research topic, both qualitative and quantitative data were collected. For this report, quantitative data, obtained through assessment scales, were analyzed using descriptive and inferential statistics, including means, standard deviations, medians, percentages, Kruskal-Wallis, and Mann-Whitney tests. Qualitative data, gathered during the semi-structured interviews, were analyzed using thematic analysis.



Figures 5 and 6. Location of the experiment, dining room (left) and experiment with a participant (right).

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2.2 Professional results (Geriatric Day Hospital - realistic environment)

Objectives

The main aim of this study was to explore and understand the various factors that could favor or hinder the integration of socially assistive robots into healthcare institutions, including organizational, ethical, and social aspects. To achieve this objective, healthcare and other hospital professionals were questioned about their interest in using the technology, as their perspectives were critical for identifying factors that support or obstruct the deployment and use of a social and assistive robot such as the project's SPRING robot (ARI model).

In addition to the results regarding the acceptability and usability of the system obtained from the interaction tests with patients and accompanying persons, we sought to pinpoint the key factors, from the professionals' point of view, likely to influence the use and adoption of an assistive robot in this kind of environment.

The results of this study should help to gain a better understanding of the potential of socially assistive robotics to improve the quality of patient care in hospitals and facilitate the work of healthcare professionals. These findings will inform future initiatives aimed at enhancing patient care and supporting healthcare staff through the implementation of assistive robotic solutions.

Participants

Eligible individuals were those who wished to participate in the study. They had to express no objection to participation and meet the inclusion criteria defined below

Healthcare professionals

- Work as a healthcare professional in collaboration with the Broca daycare hospital
- Being over 18 years old
- Have expressed consent to participating in the study

General procedure of the tests

After being informed of the procedure and signing the written consent to participate in the session, the professionals were welcomed into the designated room used for the tests in the daycare hospital. Initially, participants completed a questionnaire covering their socio-demographic data and professional information, including their area of expertise and professional experience. They then responded to a questionnaire assessing their level of comfort with and interest in technology. Subsequently, they were invited to interact with the ARI robotto observe its operation in a real-life setting. At the end of this interaction, each professional participated in a semi-structured interview conducted by an AP-HP researcher. The sessions lasted approximately 30 to 40 minutes in total.

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Assessment instruments

(a) ATI: "Affinity for Technology Interaction" scale (ATI), developed by Franke, Attig and Wessel (2019), is a questionnaire designed to assess a person's tendency to actively engage in intensive technology interaction or to avoid it. The assessment comprises 16 items divided into four main dimensions: (1) Interest in technology (4 items), (2) Confidence in using technology (4 items), (3) Comfort when interacting with technology (4 items), and (4) Technological self-knowledge (4 items).

Each item is rated on a five-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. The total ATI score is calculated by summing the responses for all items, with higher scores indicating a greater affinity for interacting with technology.

(b) Semi-structured interview on organisational, ethical and social aspects: The semi-structured interviews were designed based on the principles of the HTA Core Model® version 3.0, provided by EuNetHTA (European Network for Health Technology Assessment), to thoroughly explore the organizational, ethical, and social dimensions of introducing new health technologies in healthcare practices.

Ethical aspects: The ethical dimension (ETH) aims to describe the ethical and value issues associated with the use of health technology, highlighting potential ethical dilemmas and important ethical considerations that need to be taken into account.

Organizational aspects: The organizational dimension (ORG) focuses on the allocation of resources required to implement the technology within the organization and the healthcare system. This includes material resources, skills, knowledge, funding, and work culture.

Social aspects: The social and patient dimension (SOC) aims to describe the representations conveyed by the intervention at both individual and collective levels, considering the perspectives of patients, their relatives, healthcare professionals, and society as a whole.

Data analysis conducted

To gain a comprehensive understanding of the research topic, both qualitative and quantitative data were collected. For this report, quantitative data (gathered with the assessment scales) were analyzed using descriptive and inferential statistics (i.e., means, standard deviations, medians, percentages, Kruskal-Wallis, and Mann-Whitney tests). Qualitative data (gathered during the semi-structured interviews) were analyzed using thematic analysis (Braun & Clarke, 2006).

2.3 Software and hardware architecture evolution

Equipment

The equipment utilized in the experiments remains consistent with previous trials.

- **Robot ARI:** The ARI robot, developed by Pal Robotics, serves as the humanoid interface for engaging with patients.
- **Server (base station):** This server assumes responsibility for executing the project's applications, boasting high computing power to facilitate seamless operation.
- **Router 4G:** Dedicated solely to accessing web services, this router ensures connectivity to the cloud-based dialogue server. It is safeguarded by APN (private network without public access), firewall, and VPN protocols to ensure data security.
- **Router Wi-Fi:** This component manages the system's network communication, enabling efficient data exchange within the setup.
- **Tablet Interface:** The tablet interface empowers experimenters to control the system components—robot, server, and modules—without necessitating technical expertise. This intuitive interface streamlines operations and allows experimenters to focus entirely on the ongoing experiment.

Hardware architecture

The hardware architecture employed for the tests remained consistent with that utilized in prior experiments. During the initial phase (Wave 1), an unstable Internet connection intermittently disrupted the robot's operation. This issue was rectified prior to the commencement of the subsequent phases (Wave 2 and 3).

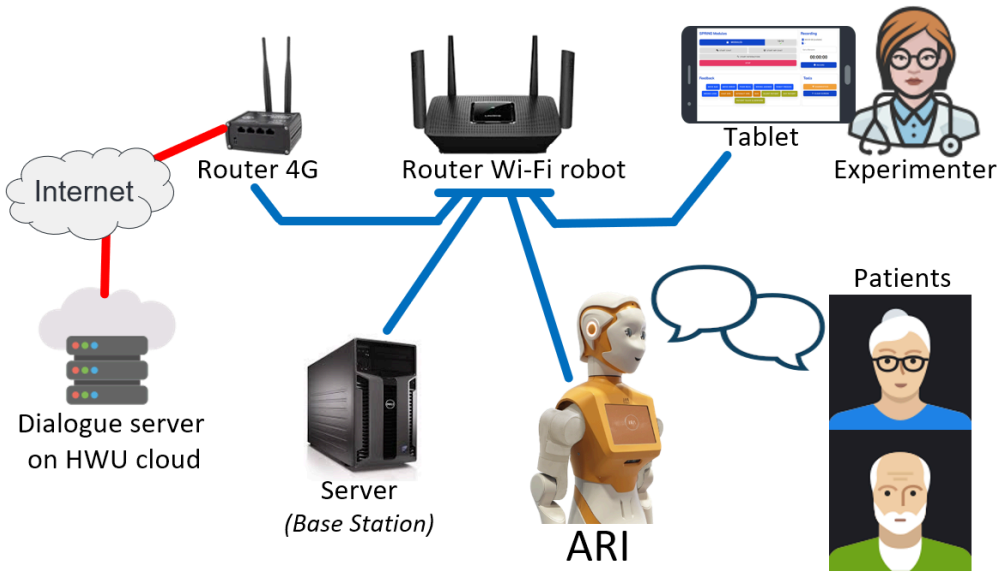

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Figure 7. Hardware architecture

Software architecture

The basic software architecture remained identical to previous assessments. Communication continued to utilize the ROS (Robot Operating System) framework, with programs encapsulated in Docker containers. The robot captured multiple audio and video streams, transmitting this data to the server for processing.

The majority of the programs, constituting the robot's intelligence, executed on the server to leverage its superior computing capabilities. Following processing, commands for movement, display, or speech were dispatched from the server to the robot.

Software evolution

Changelog for wave 1

The updates mainly concern stability and improving the robot's reactions by improving patient perception.

- Addition of diagnostic tools to anticipate and avoid operating problems
- Addition of an experimenter interface (*on tablet*) to control and supervise experiments
- Improved transcript display on robot (*larger text, dialogue display*)
- Improved depth estimation for people (*finetuning*)
- Improved tracking of people (*by introducing noise filters based on their positions*)
- Fixed the look-at actions for more robustness
- Improved the efficiency of the soft biometric module.
- Improved the overall stability of the soft biometric module and better implementation of diagonal analysis.
- Reduced the inference time and computational load associated with managing biometric profiles in memory.
- Increased efficiency of face detector and face tracker and increased robustness to environmental changes
- Face identification duplicate correction
- Improved gaze target detection model
- Addition of a lightweight and efficient monocular depth estimation module adapted to the ARI robot
- Start integration of ROS4HRI standard for the high-level planner.
- Adaptation of the planner to changes in the non-verbal behaviour generator to use ROS4HRI bodies and persons data.

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- Delivery of first version (*beta*) of a Multiparty Conversational system in the modular architecture.
- Retraining of the conversational system dialogues to improve its capabilities according to the feedback from Broca.
- Improved single speaker identification
- Added support for single speaker and dual speaker operation
- Added speech EGO filter
- Audio direction detection added

Changelog for wave 2

The updates mainly concern stability and improving the robot's reactions. As well as continuing to improve the robot's perceptions, understanding of the robot is greatly improved with the use of an LLM.

- Improved accuracy of diagnosis
- Greater use of the ROS4HRI model
- Improve ergonomics of experimenter interface (*more easy-to-read data, no more annotation buttons*)
- Added module for matching of voices and human bodies.
- Improving social behaviour in MultiParty Chat (*finetuning*)
- Reduced processing time for facial identifiers when the robot moves its head
- Improved performance of the estimated gaze model, following the results of the previous wave of experiments
- Fixed bug when people are looking straight at robot ARI
- Reduced memory and computational requirements for modules such as eye and face tracking
- Increasing the frame rate of tracked images for mapping
- Adding tools for camera calibration.
- Introduction of a new LLM-based architecture for the conversational system replacing the previous modular based architecture.
- Development of a Hospital information prompt (*in French*) for the conversational system with the open source Vicuna Large Language Model.
- Increase capabilities of the conversational system natural language processing enabling it to better understand out of scope conversations.
- Upgraded engine (*riva 2.7.0*).
- Improve speech recognition reliability and stability.
- Added hyper param for noise reduction and enhancement with a scalar threshold.
- Extended speech ego filter for ARI self speech removal (*avoid self reverberation*).

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Changelog for wave 3

These updates continue to improve the robot's stability and perception, for better reactions. This time, head movement has been added for looking at patients.

- Improve ergonomics of experimenter interface (*more easy-to-read data, no more annotation buttons*)
- Displaying the start and end of a conversation on the robot's screen
- Addition of a function to retrieve the previous facial identifiers used when a person reappears in front of the robot
- Optimising the performance of gaze estimation by adapting it to the specific environment of the project (*finetuning*)
- Increased accuracy of eye gaze analysis when people are facing the robot.
- Addiction features allowing the high-level planner and non-verbal behaviour manager to understand audio visual tracking of people interacting with the robot.
- Using gaze estimation analysis in social state information.
- Robot gaze control.
- Added speech rate configuration and the possibility of stopping speech by the experimenter.
- Updates to refine the hospital information prompt following feedback from the last experimental wave at Broca.
- Delivery of a Multy-Party Conversational system prompt with an LLM-based architecture.
- Improve speech recognition stability.
- Improved speaker identification (*changed embedding model from Ecapa to Ecapa2*).
- Improved the Voice Activity Detector.

Robot behaviour

At start-up, the robot is on standby.

1. When the patient is ready, the experimenter gives the command to start the dialogue on his tablet interface.
2. The robot initiates the conversation, asking how it can help.
3. The patient and the robot then talk together, one sentence at a time and taking turns. All their exchanges are transcribed onto the robot's screen.
4. As long as the conversion has not stopped, the robot systematically responds to the patient.
5. The end of the conversation is decided by the operator giving the stop command from his tablet interface.

From the third wave onwards, the robot is able to move its head to look at the patient.

All the other updates mainly concern improvements to the robot's perception and data processing. This does not change the robot's behaviour, but it does improve its reactions.

Interfaces

The interfaces utilized in the final tests were updated from previous versions.

Experimenter Interface (*run on tablet*):

- Start and stop SPRING modules, to prepare experimentation.
- Start and stop the dialogue, to carry out an experiment session.
- Monitor robot, server, SPRING modules and recording states.
- Annotate recordings

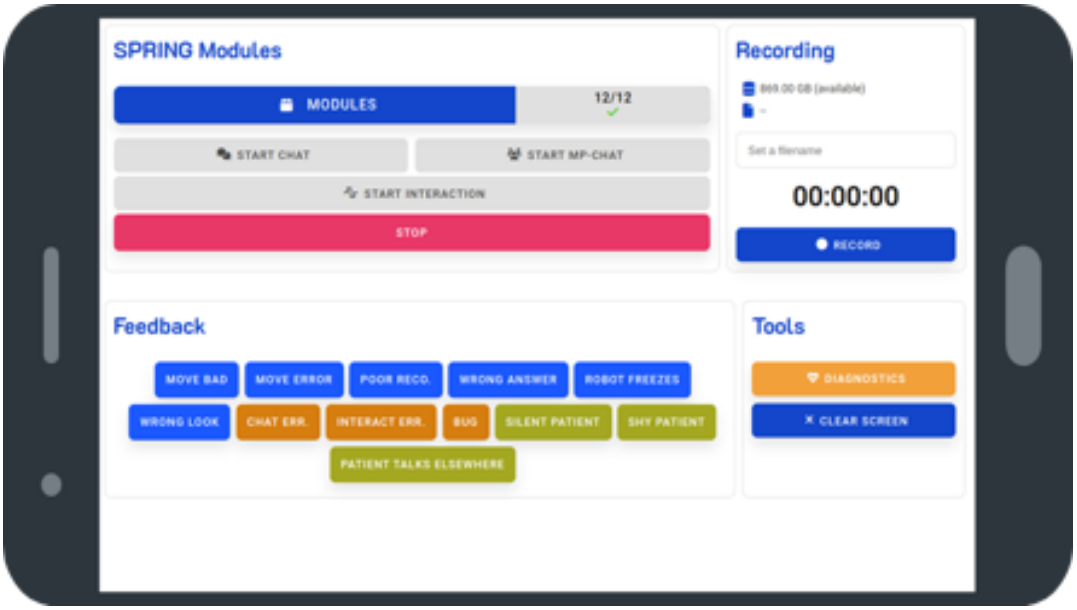
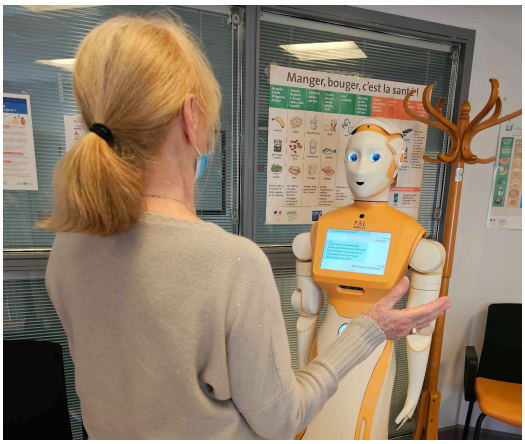


***Figure* 8.** Experimenter Interface

Patient interface (*run on robot screen*) :

- Display dialogue transcription

The ARI robot, equipped with a front screen, displays the transcript of exchanges with users, as shown in Figure X. This screen shows all the information relating to the interactions between the robot and the participants. For example, Figures 9 and 10 show the transcript of what the user said on the left (in pale pink) and what the robot said on the right (in blue). This use of the front screen on the ARI robot facilitates interactive and visual communication, making interaction more intuitive for users.



Figures 9 and 10***.*** Patient interface

3. Description of the methodology and the results of three waves of intermediate evaluations

3.1 Summary of the assessments with users (older adults and accompanying persons)

This section describes the results of the evaluations conducted within the framework of the SPRING project between May 2023 and May 2024. The results described here concern three phases of evaluation, called respectively Wave 1, Wave 2, and Wave 3.

Table 1 presents the general characteristics of these evaluations. The methodology and specific results to each wave are described in the following sections of the document.

Table 1. General characteristics of the evaluations conducted within the SPRING project in real environment (order adults and accompanying persons)

Study 2 (date)	Participants	Robot configuration	Data collected
Wave 1 (May to july 2023)	N= 20 Patients= 15 Companions= 5 F= 14; M= 6 Mean age= 77 y/o Mean educ= 13.6 y/o	Dialogue initiated by the researcher via the tablet Simple interaction Autonomous robot Dialogue transcribed on screen No robot movement No head movement	Sociodemographics Acceptability E-Scale System Usability Scale Ethics questionnaire
Wave 2	N= 49 Patients= 33 Companions= 16	Robot wave 1 configuration + **Large Language Model (LLM) integration**	

(September to December 2023)	F= 32; M= 17 Mean age= 74 y/o Mean educ= 13.7 y/o		
Wave 3 (March to May 2024)	N= 23 Patients= 16 Companions= 7 F= 17 ; M= 6 Mean age= 78 y/o Mean educ= 12.3 y/o	Robot wave 2 configuration + **Robot head movements**	

3.2 Summary of the assessments with professionals

Table 2. Characteristics of the evaluations conducted with professionals in the SPRING project

Study 2 (date)	Participants	Robot configuration	Data collected
April to May 2024	N= 15 F= 10; M=5 Mean age= 47.4 y/o	Robot wave 3 configuration	Sociodemographics Affinity for Technology Interaction Semi-structured interview: (Organisational, ethical and social aspects)

3.3 Specific description of each of the studies conducted in a real environment, patients and accompanying persons

Objectives

The main objectives of each of the three assessment waves were as follows:

Collect **user data during human-robot interaction** in a relevant context, in order to transmit it to the technical partners responsible for developing and programming the SPRING system. This includes collecting data on vision, navigation, dialogue, as well as emotional and engagement aspects.

Assessment of the **acceptability and usability** of the SPRING robotic solution, as well as discussion of the **ethical issue**s associated with the introduction of a social and assistive robot in a hospital environment, in consultation with the end-users, i.e. elderly people : patients and their carers.

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Material

The platform used for the tests was the robot ARI. ARI is a social assistant robot (PAL robotics) that is programmed, within the framework of the SPRING project, with a set of modules developed explicitly for this project. The robot mobilises perceptual (audio and visual), proprioceptive (localization in space), conversational (language processing), and behavioural (adapting its proposals to the users' behaviour) information. This technical development work has been ongoing since the beginning of the project. The interactive versions of the modules are regularly integrated and evaluated in the different evaluation waves organised throughout the project.

The robot is programmed to provide support or distraction according to the user's request and the characteristics of the context of the human-robot interaction to act in an adapted manner. The general features of the ARI robot are described in Table 3.

Table 3. Technical presentation of the ARI robot.

	**PHYSICAL CHARACTERISTICS** - Height: 1,68 m - Weight: 50 kg - Moves by rolling - Articulated arms (cannot carry anything) **INTERFACE** - Emergency stop button on the back - Touch pad - Animated eyes - Luminous ears **AUTONOMY** - 8 to 12 hours of battery life **CONNECTIVITY** - Wired and wireless, (Wifi, Bluetooth) **VISION** - 3 cameras (head, chest and back) **AUDIO** - 4 microphones	

The specific configuration of the robot for the evaluation of the three waves of tests in a real environment included the following features:

- The researcher launched the various modules and chats via the tablet. He could also use the tablet to report any problems,
- The robot was used autonomously to respond to the participants,
- The robot's voice was adapted before the interaction for each of the participants,

- The robot displayed dialogue subtitles on its screen,
- The robot was positioned at a fixed point and no movement of the robot was taken into account,
- The robot's eyes moved randomly, to increase its "liveliness", without really focusing on the person,
- For wave 3, slight movements of the robot's head were introduced.

Procedure

Two weeks prior to the experiment, the researcher accessed the hospital software (Orbis) utilized for managing patient appointments. The aim was to identify patients scheduled for a daycare hospital consultation. Upon confirming that patients met the study's inclusion criteria, the researcher contacted them via telephone to introduce the study and extend an invitation to participate during their waiting period at the daycare hospital. If patients agreed to participate, the researcher verified their postal addresses to ensure prompt delivery of the information letter.

On the day of the experiment, the experimenter met the participants in the day hospital waiting room and escorted them to the dining room where the Ari robot was stationed. Upon arrival, the experimenter reiterated the purpose of the study, emphasizing the "reception and orientation" use case. Participants were encouraged to engage with the robot naturally, simulating typical interactions encountered upon arrival at the hospital, which often involve seeking orientation within the facilities.

<u>The included actions within the use cases encompassed:</u>

a) The robot greets and welcomes hospital users.
b) The robot dispenses information and reminders regarding preventive hygiene measures.
c) The robot assists patients throughout their care process.
d) The robot offers orientation and guidance concerning hospital services.
e) The robot provides entertainment activities for individuals attending the hospital.

Participants were requested to sign consent and authorization forms for audio and voice recording. Subsequently, participants positioned themselves in front of the robot to commence the interaction. The interaction was captured on video while the robot autonomously responded to the participants' inquiries. Participants were encouraged to pose a range of questions, including queries about the whereabouts of consulting rooms, the cafeteria, or restrooms (refer to Figures 11 and 12).

Figures 11 and 12. Examples of interaction between the participant and the robot in the experiment Wave 3.

Following the initial setup, participants engaged in an interaction lasting approximately 10 minutes, though duration varied based on participants' inquiries. During this interaction, the robot was equipped with various dialogue content programmed to address users' questions (refer to Table 4).

Table 4. Examples of dialogue contents managed by the robot

Type of question asked by the user	Robot responses
User (Patient - wave 1): *"Hello, what's your name?"*	ARI: *"My name is ARI, I am a sympathetic robot in a Daily Care Hospital. I am happy to help you at this time"*
User (Patient - wave 2): *"I wonder what role robots will play with hospital patients"*	*ARI: "Robots can play an increasingly important role in the healthcare sector, helping both healthcare professionals and patients. They can be used to perform repetitive tasks."*
User (Accompanying person - wave 3): *"I'm looking for consultations."*	ARI*: "Consultations take place from Monday to Friday, from 10.30am to 4pm. If you would like to find out more about consultations, or if you would like to book one, please contact the Day Hospital reception desk."*
User (Patient - wave 3): *"What are the specialities in geriatrics?"*	*To User : "Of course. I can refer you to the geriatric specialities in our day hospital. It is mainly designed to care for patients with cognitive disorders such as Alzheimer's disease and cerebrovascular disease."*

Assessments

Upon completion of the interaction task, a comprehensive set of assessments was administered to gain insights into users' experiences and perspectives regarding the robot's functionality and utility. These assessments comprised:

- Collection of socio-demographic data, including gender, age, and socio-educational level.
- Evaluation of system acceptability using the **Acceptability E-Scale (AES).** Participants provided responses to six items on the scale, accompanied by qualitative feedback, utilizing a 5-point Likert scale (scale in Annex 3).
- Assessment of system usability through the **System Usability Scale (SUS)**. Participants were asked to articulate reasons for their responses to each of the ten items on the scale (scale in Annex 2). Participants were prompted to rate the perceived usefulness of each use case type using a Likert scale (1: totally useless, 2: rather useless, 3: slightly useful, 4: useful, 5: totally useful). Similar to the acceptability scale, participants were encouraged to elaborate on their responses.
- Subsequently, **semi-structured interviews** were conducted to explore **ethical considerations** linked to the integration of robots into the hospital environment. These discussions encompassed topics such as the risks related to data collection used to make the robot operate, potential replacements of professionals by robots in the healthcare field, errors attributable to robots, and the potential development of emotional bonds between patients and robots.

3.3.1 Results Wave 1 experiment (Day Care Hospital - Real environment)

Period: March to July 2023

Socio-demographic data - Wave 1 (all participants)

A total of 20 volunteers took part in this evaluation. The socio-demographic data corresponding to the participants are presented in table 5.

Details of the recruitment procedure are given in section "*3.3 Specific description of each of the studies conducted in a real environment, patients and accompanying persons - Procedure*".

Table 5. Socio-demographic data for participants in “Wave 1” - All participants (n=20)

Variable	Modalities	Total
Count	-	20 (100%)
Gender	Male	6 (30%)
	Female	14 (70%)

Profile	Patient	15 (75%)
	Accompanying person	5 (25%)
Age, years	*Min: 45* ; *Max*: 92 *Mean:* 76.7 y/o *SD*: 10,23	
Socio-educational level	*Min: 9*; *Max*: 15 *Mean:* 13,65 years *SD*: 2,05	

Acceptability of the robot - Wave 1 (all participants)

This section presents the results obtained in the evaluation using the AES (Acceptability Scale). Figure 13 displays the total scores given by the 20 participants (patients and accompanying persons) on the AES.

On this scale, only 14 out of 20 participants answered all the questions. The remaining six participants did not complete the scale as they were called for their medical appointments and opted not to continue with the experiment.

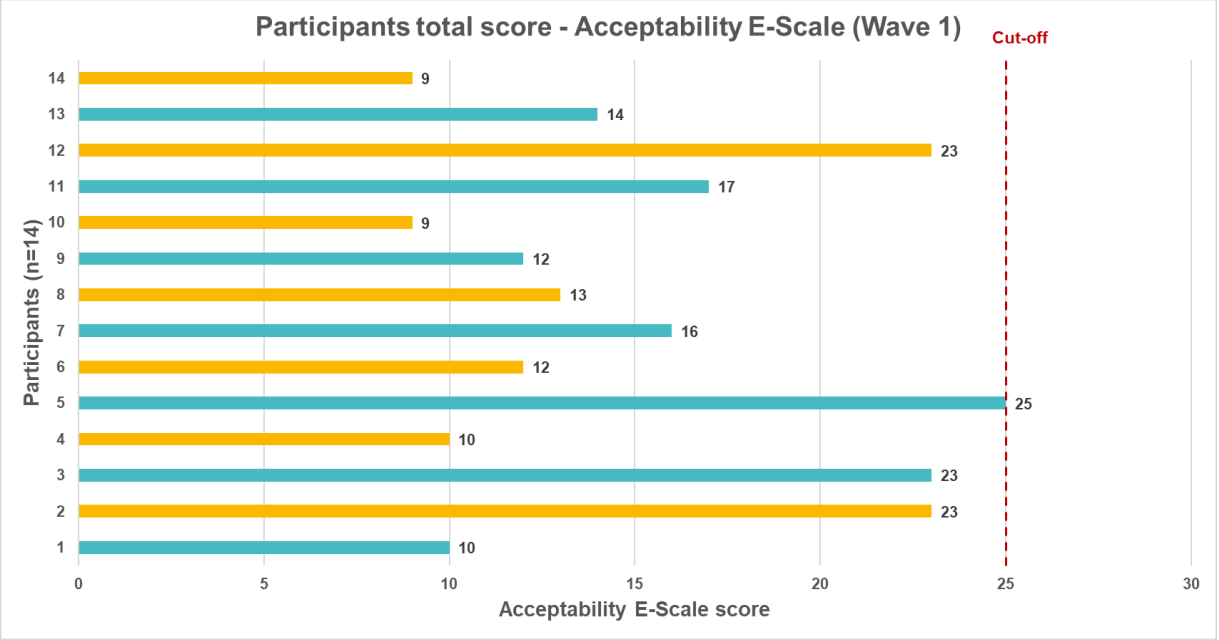


Figure 13. Mean global scores (AES) for the assessments in the "Wave 1" - patients and accompanying persons (n=14)

Participants in Wave 1 reported a mean total score of **15.43** (SD=5.81) **out of 30**. The median for this sample was 13.5 out of 30. The threshold for acceptability of the AES is set at 25/30, indicating a level of acceptability below the acceptable in our sample. Only one participant

(companion) reported a score above this threshold (25/30). The scores of participants in this 1st wave ranged from 9 to 25/30.

71.4% of participants reported a score below 20, 21.4% between 20 and 25, and 7.2% above 25. Figure 14 shows the average scores for each dimension of AES for the entire first wave sample (n=14 participants).

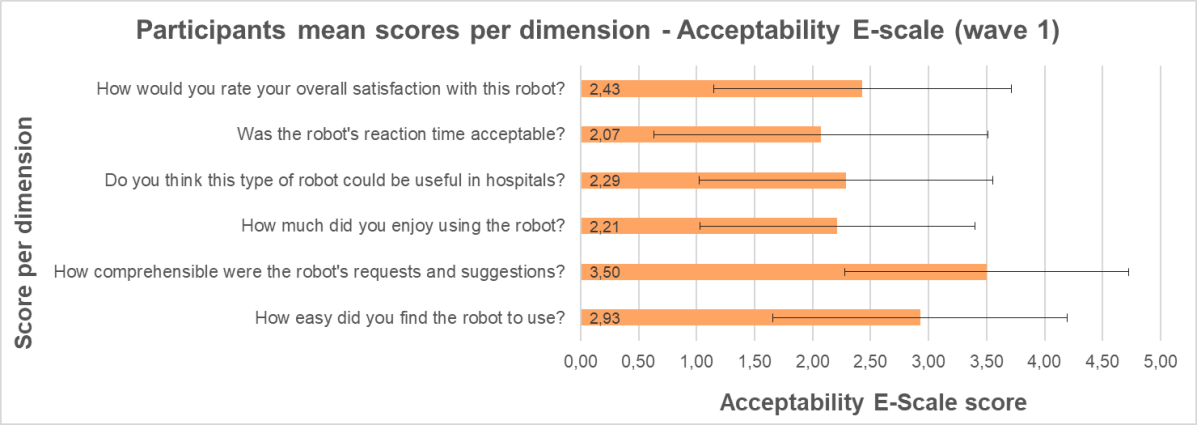


Figure 14. Acceptability E Scale scores per dimension in "Wave 1" - All participants (n=14)

Participants' scores across the various dimensions of the acceptability scale displayed a degree of uniformity, with higher scores observed for dimension 2 - robot comprehensibility (M=3.5; SD=1.22). In comparison, more average scores were reported for the remaining dimensions: dimension 1 - acceptability of the robot (M=2.93; SD=1.27), dimension 3 - pleasure in using the system (M=2.21; SD=1.19), dimension 4 - usefulness of the robot in the hospital (M=2.29; SD=1.27), dimension 5 - appreciation of the system's response time (M=2.07; SD=1.44), and dimension 6 - overall satisfaction with the system (M=2.43; SD=1.28)

In the following section, we provide an analysis of the participants verbatim associated with the questions about the acceptability of the robot.

Ease of use of the robot (AES): The findings on this item reveal diverse opinions within the sample. Some participants expressed dissatisfaction due to the robot's inability to provide direct answers to questions. However, others perceived it positively, emphasising the convenience of verbal interaction without the need for writing.

> "*We ask him a question and it [the robot] doesn't answer the question so it's rather average.*" [..] "*Really average... more than average*" (P004FM)

> "*On the face of it, it's easy. You don't have to write, just talk.*" (P009MMH)

> "*Easy*" (P008GC)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

"*I'd put 1. It [the robot] doesn't answer any questions.*" (P039SJ)

Robot comprehensibility (AES) : The findings regarding this item reflect varying perspectives among individuals testing the robot. While some participants found the responses off-topic, others viewed them positively, finding them easy to comprehend and even humorous. Some participants suggested considering the robot's limitations in their assessment.

"*Understandable and ridiculous! In other words, it [the robot] wasn't answering what I was asking. How silly is that?*" (P004FM)

"*They were completely understandable and easy, but it [the robot] offers to go for lunch a lot. It makes us smile.*" (P009MMH)

"*If it is like that [the robot], it's because he doesn't work. You have to take into account his weakness.*" (P013LJ)

"*It was annoying because he didn't understand anything and made me repeat myself*" (P025BMV).

"*I'd give it a 2. If it's like that it's because it doesn't work.*" (P039SJ)

Enjoyment in using the system (AES): The findings concerning this item reflect the perspectives of individuals testing the robot. While some participants expressed a preference for human interaction over robotic assistance, acknowledging the inevitability of technological integration, others simply noted the practicality of the system.

"*I'm not much of a robot either, I prefer the physical [human service], but I know we're going to go through it in time, so we have no choice.*" (P013LJ)

"*It's practical, yes.*" (P009MMH)

Usefulness of the robot's responses (AES): The findings on this item reflect diverse perspectives among individuals testing the robot. Some participants highlighted the importance of familiarity with the robot for ease of use, while others mentioned specific scenarios where they could foresee utilizing its assistance. Some participants expressed dissatisfaction with the robot's response, indicating a need for clearer guidance.

"*We're not used to it [the robot]. When you're used to it, it's easy, but not for the first time. It's a bit confusing. You have to be used to it.*" (P008GC)

"*I can manage on my own. The only question is when I'll be looked after. I don't know what to say. I don't feel like drinking, or going to the toilet, but I could have asked him where to sit.*" (P009MMH)

"When I inquired about the location of the daycare hospital floor, [the robot] provided a prompt response, simply stating 'it's next door,' which sufficed for me. However, it would have been preferable if it had accompanied me. From my perspective as an able-bodied individual, the response was satisfactory; I asked a question, and it provided the necessary information. Nonetheless, upon arriving at the designated floor, we encountered two professionals who were delightful. Upon querying them, they directed us to the elevators on the first floor. It was pleasant to be greeted by someone upon arrival." (P013LJ)

"*It [the robot] didn't answer well, it said it was next door, it didn't say it was on the first [floor].*" (A001LJ)

"*Between 3 and 4. He said it was on the first floor anyway. He said how it would be.*" (P039SJ)

Appreciation of the robot's response time (AES) : Many participants expressed a perception of slowness in the robot's responsiveness, noting instances where they felt compelled to repeat their inquiries.

"*Yes, quite [acceptable]*" (P013LJ), "*Yes, you, he answered you straight away. He didn't understand me.*" (A001LJ)
"*But it was a bit slow. Sometimes you feel like repeating the question.*" (P009MMH)

"*Well, the time he spoke right away but without answering so it's not good.*" (P025BMV)

Overall satisfaction with the robot (AES) : Findings regarding this item reflect a range of opinions among participants. While some participants appreciated the novelty of interacting with a robot, others emphasized its practical utility. Some participants highlighted the positive and cheerful demeanor of the robot, associating it with an uplifting atmosphere. However, contrasting perspectives also emerged, with some participants expressing dissatisfaction and concern over the robot's effectiveness, particularly in environments with vulnerable individuals. Others conveyed frustration, indicating a negative perception of the robot's performance.

"*Very nice, it's nice to see a robot. But the human person is nicer.*" (P008GC)

"*Again, I didn't have much to ask it [the robot]. But I find it useful.*" (P009MMH)

"*I find it very nice [the robot]. I think it is nice and funny. And I love yellow. It's the sun. If it's grey, you'll have grey people in front of you. If you put something cheerful with*

sunshine, you'll get cheerful people. I think the bright side that represents it, can't help but rub off on people." (P013LJ)

"*I didn't get any satisfaction, it didn't help me at all. It's frightening. I had the impression that it [the robot] didn't understand anything, and that if we leave things like that, people will turn in all directions. It's going to be catastrophic. What's more, in establishments like this, where the people are older, many of them are vulnerable. I think it's terrible.*" (P039SJ)

"*Listen, until it works better, it [the robot] sucks.*" (P025BMV)

Acceptability of the robot - Wave 1 (Patients)

In Wave 1, patients reported a mean acceptability score of 14.73/30 (SD=5.73), with a median of 13. These results suggest that the overall acceptability level, as measured by the AES scale, falls below the acceptability cut-off set at 25/30. None of the patients reported a score above this cut-off. The scores within the 1st wave varied from 9 to 23/30. Specifically, 72.73% (n=8) of patients reported scores below 20, while 27.27% (n=3) fell within the range of 20 to 25, with none scoring above 25. For a visual representation of these findings, please refer to Figure 15, which illustrates the average scores for each dimension of the AES for the Wave 1 sample (n=11 patients).

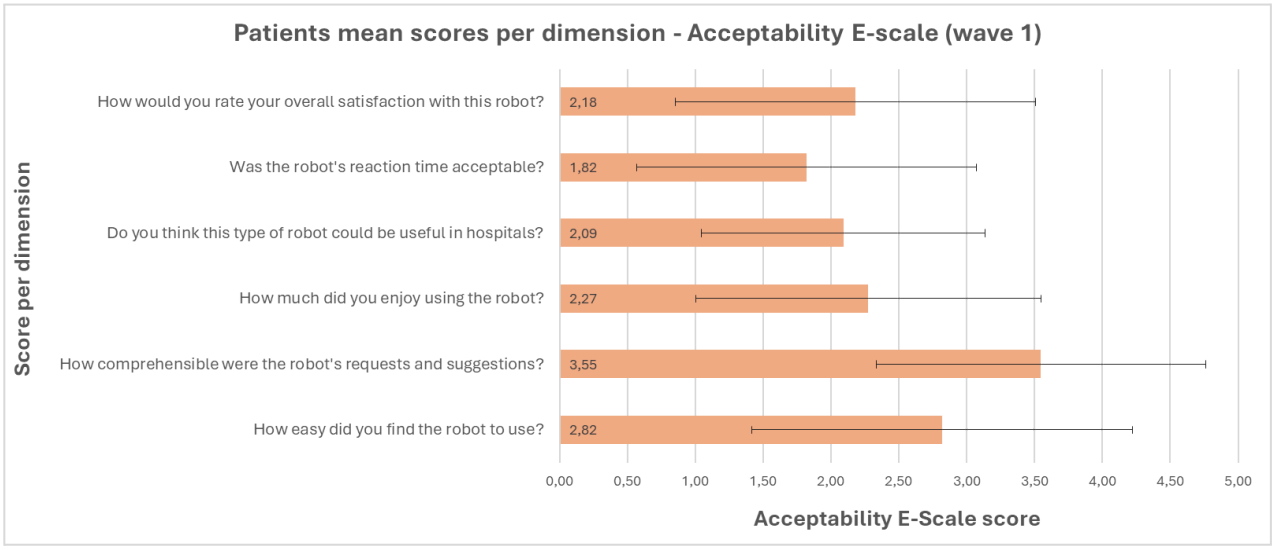


Figure 15. Acceptability E Scale scores per dimension in "Wave 1" - patients (n=11)

Patients' scores across the dimensions of the acceptability scale were relatively consistent, with notably higher scores in dimension 2 - *robot comprehensibility* (mean=3.55; SD=1.21). Other dimensions yielded more moderate scores: dimension 1 - *acceptability of the robo*t (mean=2.82; SD=1.40), dimension 3 - *pleasure in using the system* (mean=2.27; SD=1.27), dimension 4 -

usefulness of the robot in the hospital (mean=2.09; SD=1.04), dimension 5 - a*ppreciation of the system's response time* (mean=1.82; SD=1.25), and dimension 6 - *overall satisfaction with the system* (mean=2.18; SD=1.33).

Acceptability of the robot - Wave 1 (Accompanying persons)

Accompanying persons in Wave 1 reported a mean total score of **18** (SD=6.56) **out of 30**. The median for this sample was 17 out of 30. The threshold for acceptability of the E scale is set at 25 out of 30, indicating a level of acceptability below the acceptable, and one patient reported a score above this threshold (25/30). The scores of participants in the first wave ranged from 12 to 25 out of 30.

66.67 % (n=2) of accompanying persons reported a score below 20, 33.33 % (n=1) between 20 and 25, and nobody above 25. Figure 16 shows the average scores for each dimension of AES for the entire first wave sample (n=3 accompanying persons).

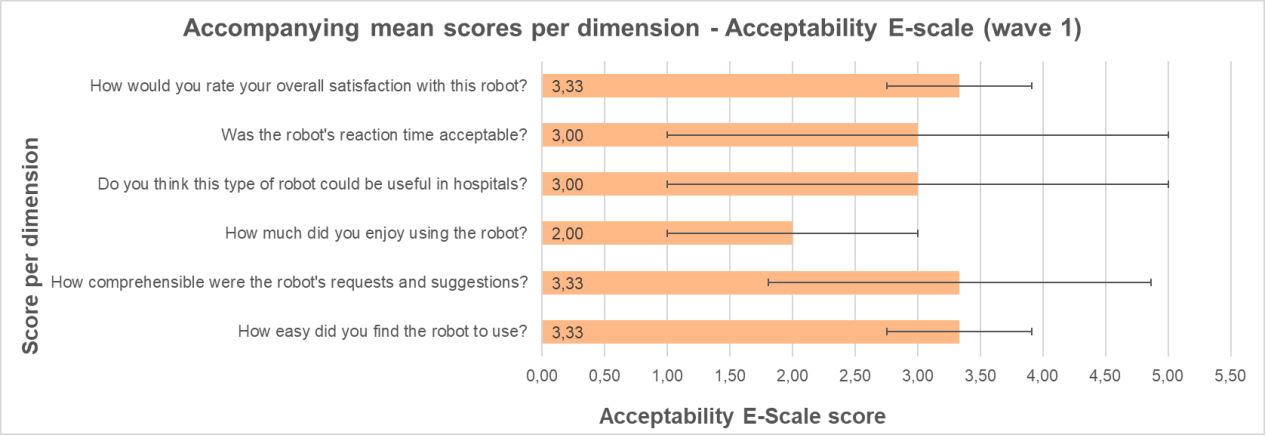


Figure 16. Acceptability E Scale scores per dimension in "Wave 1" - Accompanying persons (n=3)

Accompanying person's scores on the various dimensions of the acceptability scale were fairly homogeneous, with higher scores for dimension 2 - *robot comprehensibility* (M=3.33; SD=1.53)

More average scores were reported for the other dimensions: dimension 1 - *acceptability of the robot* (M=3.33; SD=0.58), dimension 3 - *pleasure in using the system* (M=2; SD=1), dimension 4 - usefulness of the robot in the hospital (M=3; SD=2), dimension 5 - *appreciation of the system's response time* (M=3; SD=2) and dimension 6 - *overall satisfaction with the system* (M=3; SD=0.58).

Usability of the robot - Wave 1 (all participants)

In assessing the ease of use of the device, the System Usability Scale (SUS) was employed. During Wave 1, accompanying persons recorded a mean SUS score of 47.86 (SD=24.18; median=52.5),

categorizing the usability as "Poor" and below average according to SUS standards. For context, SUS scores are considered unacceptable below 52, marginal from 52 to 72, and acceptable above 72.

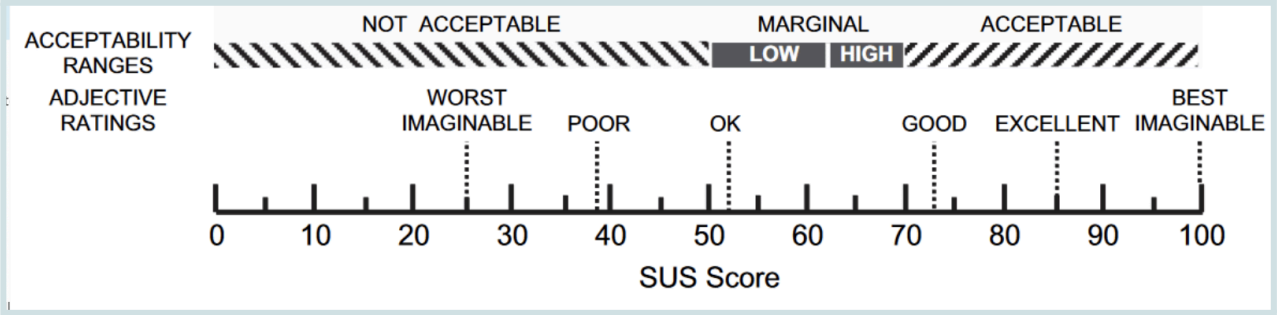


Figure 17. SUS scale acceptability rank

Figure 18 presents the scores given by the 14 participants on the SUS usability scale.

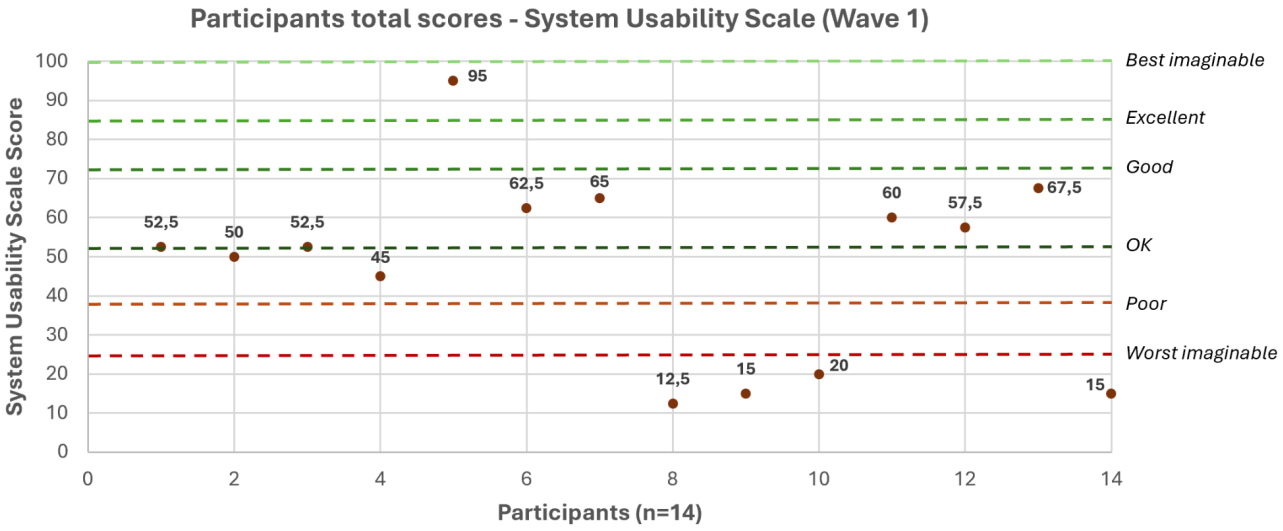


Figure 18. System Usability Scale Mean global scores in "Wave 1" – All participants (n=14)

The table 6 below presents a detailed analysis of the transformed scores for the t System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 6.** System Usability Scale scores per dimension in "Wave 1" - All participants (n=14)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	1.71	0.99	0	3
2) I find the system unnecessarily complex.	1.79	1.12	0	4
3) I think the system is easy to use.	2.64	1.34	0	4
4) I think I would need the help of a technically skilled person to use this system.	1.64	1.55	0	4
5) I found the various functions in this system to be well integrated.	1.79	1.58	0	4
6) I think the system has too many inconsistencies.	1.14	1.29	0	3
7) I imagine that most people would learn to use this system very quickly.	2.29	1.64	0	4
8) I found the system very difficult to use.	2.07	1.77	0	4
9) I felt very confident using this system.	2.00	1.47	0	4
10) I think there is a lot to learn before one can effectively use this system.	2.07	1.54	0	4

Qualitative feedback given by all participants (patients et accompanying persons) regarding the usability assessment is presented below.

I'd like to use this robot in hospital as often as possible (SUS): Responses varied significantly, with some participants expressing a preference for human interaction over the robot, which they viewed as less practical or even unnecessary for frequent visitors familiar with the hospital layout. Others noted that while the robot might be helpful for first-time visitors, its routine use could potentially lead to staff reductions and a depersonalized environment, factors that influenced their reluctance to use it frequently.

> "*I prefer the human person. That's a toy [the robot].*" (P008GC)
>
> "*It's complicated. I don't need anything. I don't even have to ask it where I sit. But if it had been the first time, yes. It depends on how you come to the hospital. If you come every month, you're familiar with it, but when you're new, you don't know.*" (P009MMH)
>
> "*I'd rather have a person than a robot, so I disagree.*" (A003GM)
>
> *"I'm not sure how often I would use the robot. If its presence leads to staff reductions and dehumanizes the environment, then I would be against using it."* (P025BMV)

I find conversations with this robot unnecessarily complex (SUS): Findings reveal a range of opinions among participants testing the robot. While some found the conversations straightforward but not always relevant, others described the interactions as somewhat intricate

and confusing. Additionally, there were comments suggesting that while the interactions were not complex, they were out of sync and needed improvement.

> "*Is it complex? No, but it [the robot] answers next to it.*" (P004FM)
> "*A little bit. It [the robot] speaks only about the meals.*" (P009MMH)
> "*Yes. Unnecessarily complex I might well agree.*" (P039SJ)
> "*Not complex but needs improvement.*" (P018TD)

I think this robot is easy to use (SUS): Some participants found the robot easy to use due to its voice responses and lack of a keyboard, while others experienced difficulties, noting that the robot often failed to answer questions accurately or struggled with responses

> "*Well, if it [the robot] answered the questions we ask. But it didn't answer the questions. It's no good.*"(P004FM)
> "*Yes, easy. No keyboard is required*" (P009MMH)
> "*I didn't have any difficulties at my level. It [the robot] was the one who had trouble responding.*" (P018TD)
> "*The [robot's] voice [audio information] comes in handy because I can't see clearly.*" (P029GA)
> "*I don't really know, it's complicated to talk to it.*" (A002EM)

I think I'll need help to be able to interact with this robot (SUS): most of the participants thought that they would need some help (at least at the beginning) before being able to interact with the robot.

> "*No, I don't want to interact with it [the robot]. I don't want anything. You've got that right.*" *(P004FM)*
>
> "*Yes, you have to show first.*" *(P008GC)*
>
> *"We need help when he doesn't understand the question. Otherwise he answers the questions."* (P009MMH)

***I thought the robot's various services were well thought out (SUS)*:** most of the participants thought that the robot was not functioning properly because it did not understand their questions and was not able to give them appropriate answers.

> "*But I can't answer! Because he always gave the wrong answer. I don't want to cast stones at the people who designed it. That's not what I think. I think there's something wrong with it because frankly it doesn't work.*" (P004FM)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

"*Yes, but it's hard to know what he's doing. But he has to look at us. It's his attitude that bothers me. He's not interested. It bothers me a bit.*" (P008GC)

"*He suggests useless things, in my case. So for me, no. He said useless things to me. In my case, it didn't concern me.*" (P009MMH)

"*I don't really know. But I didn't get any answers to my questions.*" (P029GA)

"*No, it's a robot.*" (A005GM)

I think there are too many inconsistencies in this robot (SUS): most of the participants thought that the robot had inconsistencies. However, some participants considered that it was coherent in its answers.

"*Well.. he's incoherent, he's not answering my question.*" (P004FM)

"*Incoherent, no. It's his attitude that bothers me, he doesn't look at me.*" (P008GC)

"*It could well be, yes. I completely agree. The maximum. I'm blowing the budget.*" (P013LJ)

"*I disagree, it's going very well.*" (A001LJ)

"*Incoherent no. He didn't understand what I wanted.*" (P009MMH)

I imagine that most people would be able to learn to use this robot very quickly (SUS): the participants thought that learning to use the robot was feasible. However, they expressed concerns for older people who might not be familiar with technology or suffer from cognitive impairment and foreign people who might not be able to speak French (although the robot might be able to recognize the language and shift language according to the interlocutor).

"Maybe, but you have to want to use it." (P008GC)

"It's international now [the hospital]. It might be useful to have translators who understand the people who come here. The Italians speak with their hands, the robot won't understand. It needs a video. It's important to be able to emphasise that." [...] "Not necessarily this robot, but we should consider a robot that can speak and understand all languages. Like with Google, the translator when you go to a foreign country. Imagine you're ill and they send you to France, because it's the most reassuring environment for your illness. The French can't speak other languages. They tell me to go to New York,

because that's the only place I can have an operation. Even being resourceful, I'd be lost. I think that with the new technology we have today, I might as well go ahead."(P013LJ)

"In other words, he won't understand people who don't speak French? He doesn't understand me. And there are plenty of people here who speak other languages. Yes, and even though I have a clear voice, there are people who speak softly. And those with hearing aids."(A001LJ)

"*Yes. You just have to ask him a question, but he has to answer the right questions. So that we understand each other.*" (P029GA)

"*Yes it's very easy.*" (P009MMH)

"*If it's aimed at older people I don't think so.*" (P022EG)

I found it very difficult to talk and behave naturally with this robot (SUS): Most people noted that it would be difficult for them to interact naturally with the robot. They thought that they would need some time to become used to this interaction.

"*In other words, I talk to him as if he existed. It's embarrassing. It's confusing. You have to get used to it. I'm not against it.*" (P008GC)

"*I haven't had any difficulties, at my level. He's the one who has difficulty answering*." (P018TD)

"*Difficult, I didn't have too many questions for him. But we're not used to that. At home I've got 'OK Google', so I use it, it's useful, as I can't see clearly. My children installed this for me and I use it to cook, to find out what the weather's like. Sometimes I ask for words because I can't remember what they mean, like the cooking time for artichokes.*" (P029GA)

"*You can't be natural it's a robot.*" (P009MMH)

"*I didn't have too many questions for him. But we're not used to that.*" (P029GA)

"*It's difficult to be natural with the robot.*" (P022EG)

I felt very confident using the robot (SUS): some participants felt confident with the robot while others thought that they needed more interactions with it to know if they could rely on it.

"*Yes, it didn't bother me, not at all.*" (P008GC).

"*It was difficult in the sense that we didn't really have any exchanges.*" (P022EG)

I think there's a lot to learn to use this robot properly (SUS): the participants noted that the users did not have anything to learn to use the robot if it works properly.

> "*I don't think so. If he answers the questions correctly, in my opinion, it shouldn't be difficult."* (P004FM)
>
> "*No, not necessarily. All he has to do is talk."* (P009MMH)
>
> *"No, there's nothing to learn, but he's the one who has to be put in place, I turned the questions round differently, he didn't understand.*" (P013LJ)
>
> "*If people don't speak properly, he won't understand, so things will drag on and the patient will have to wait his turn? You get shouted at in the background.*" (A001LJ)
>
> "*There's nothing to learn.*" (P020CA)
>
> "*There shouldn't be. Otherwise there's no point.*" (P029GA)
>
> "*No, it's quite intuitive.*" (A001LJ)
>
> "*Yes, there's a lot to learn.*" (P013LJ)
>
> "*You don't have to learn anything, you just have to talk to him.*" (P018TD).
>
> "*You shouldn't do that. Otherwise there's no point.*" (A005GM)

Usability of the robot - Wave 1 (patients)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 2, patients reported a mean score of 45.45 on the SUS scale (SD=20.21; med=52.5), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 7 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

Table 7. System Usability Scale scores per dimension in "Wave 1" - patients (n=11)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	1.55	1.04	0	3
2) I find the system unnecessarily complex.	1.64	1.03	0	3

3) I think the system is easy to use.	2.45	1.37	0	4
4) I think I would need the help of a technically skilled person to use this system.	1.36	1.29	0	4
5) I found the various functions in this system to be well integrated.	1.91	1.45	0	4
6) I think the system has too many inconsistencies.	0.91	1.14	0	4
7) I imagine that most people would learn to use this system very quickly.	2.18	1.54	0	4
8) I found the system very difficult to use.	2.27	1.68	0	4
9) I felt very confident using this system.	1.91	1.51	0	4
10) I think there is a lot to learn before one can effectively use this system.	2.00	1.48	0	4

Usability of the robot - Wave 1 (Accompanying persons)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 2, accompanying persons reported a mean score of 55 on the SUS scale (SD=28.28; med=55), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 8 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 8.** System Usability Scale Scores per dimension in “Wave 1” - Accompanying persons (n=3)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.33	0.58	2	3
2) I find the system unnecessarily complex.	2.33	1.53	1	4
3) I think the system is easy to use.	3.33	1.15	2	4
4) I think I would need the help of a technically skilled person to use this system.	2.67	2.31	0	4
5) I found the various functions in this system to be well integrated.	1.33	2.31	0	4
6) I think the system has too many inconsistencies.	2.00	1.73	0	3
7) I imagine that most people would learn to use this system very quickly.	2.67	2.31	0	4
8) I found the system very difficult to use.	1.33	2.31	0	4

9) I felt very confident using this system.	2.33	1.53	1	4
10) I think there is a lot to learn before one can effectively use this system.	2.33	2.08	0	4

Semi Structured interview on the ethical dimension - Wave 1

This section presents the main opinions given by the participants regarding the ethical issues addressed in the semi-structured interview (see annex 4). Some participants' verbatims were extracted from the interview transcripts and used to illustrate different views.

1/ Opinions regarding the development and use of robots with human-like appearance (humanoids): opinions about the appropriate appearance of the robot differed between participants. Most of them thought that a human-like appearance was the most appropriate because we are supposed to talk with it and because the human-like appearance was appealing for them than any other aspect of the robot. However, some participants suggested that the robot could look like an object because they thought it was important to show that robots are machines. Other participants said that an animal robot would be fun to watch and to interact with.

> "*No. Because I think for a lot of people they might think it would be human.*" [...] *"Because when you talk about robots you're talking about characters.*" (P004FM)

> *"I can't see a horse talking. So it's better if it's a human. If it's an animal it would be weird if it spoke."* [...] *"If it's a dog it'll bark."* [...] "*It should smile more."* [...] *"He's a bit dull, a bit pale. He's a bit pale. So warmer colours. It looks like a death mask. Eyebrows. The face is empty. It should be more human. It should smile. Now it's really human. I don't like talking to a robot."* [...] *"And he's tall. It looks like a machine, which isn't very human. When you go into a hospital and it's a robot greeting you, you wouldn't trust it."* (P008GC)

> "*Yes, I think it's more fun than a square machine.*" [...] "*It catches the eye, it's nice.*" [...] "*He looks a bit like a child's robot. I'd rather see him in a white coat so you can see he's in hospital than representing the staff.*" [...] "*I don't like him very much. I told you I see him in a white coat. I don't like him looking like a machine. At the Town Hall he had a big tablet, it's not pleasant. And the fact that he's either a robot or a human being, I like that, you can't go wrong.*" (P009MMH)

> "*I think it's a bit too big. It's too imposing. I have more of an image of little Japanese robots. It's more difficult. I don't mind little Japanese robots. But this is too imposing.*" [...] "*As they're robots, they might as well have a shape that looks like a human*." [...] "*It's a woman*' [...] "*At first I had my doubts, but she's got beautiful blue eyes and a very feminine shape. And a dress is more feminine than masculine.*" (P030LM)

"*Yes and no. It doesn't have to replace a human. If it looks like a human, that's fine. Let's just say that we're not going to address it as a real human. It's a fake human.*" [...] "*A human from another planet. But the face and arms look the same.*" (P031VG)

"*I wouldn't have called him ARI in the first place, because I think he looks more like a woman than a man.*" [What would you have called him?] "*Zoé*." (P033GG)

"It's better to have to talk to a robot that looks like a human than a square computer or a machine. It's more fun and as a result we might let loose more with the robot than with a computer." [...] "*Yes, especially at the beginning when you're not used to it, it's fun to talk to a robot*." [...] "*You won't be blocked, you'll be able to ask it anything you want. I don't know why, but it's just an impression, that's all*." (P035PC)

"*No, it scares me. I find robotics completely dehumanised*." [Would it be OK if the robot didn't look like a human?] "*Maybe it would be better. We're already more often confronted with this kind of thing. For example, you have medical consultations and I've been to Bicêtre you have to scan your summons and then answer questions at the end it's easier to do it like that.*" (P039SJ)

"Why not, it's more reassuring." [...] "*It's better to have a robot with human forms than headphones like museums do. It's more pleasant.*" (P018TD)

"*I haven't really thought about it, but why not if you know it's a robot.*" [...] "*It's the outside, it's still a machine, it could be a square, we're doing a human, it could be a dog, whatever. It's just the representation. It's the use that matters. It's a machine for me*" (A005GM).

"*You have to realise that it's a machine. There's nothing human about it apart from the face, and even that's not human. Even if I can't see clearly, I've understood that it's not human.*" (P029GA)

"*I don't really like it. I think it's a bit ugly. I think it's ugly because it doesn't look like a man or a toy. It needs a bit more imagination instead of a humanoid.*" [...] "[I'd like] *in the form of a machine. I find the reference to anthropomorphising a machine a bit silly. Or it must be funny.*" [...] *"It should be funnier. It's a bit minimalist.*" [...] "*That's what bothers me - you shouldn't make a man out of him. Why make him a man when he's a machine?*"

"*It would be more fun in a medical context to use an animal. An animal aspect could amuse them and encourage interaction. As we see in Japan, it could be more fun. If it's intended for the people in this department, it might encourage more interaction.*" [...] *"I want something fun. Keep it serious but still fun. Something fun*." [...] "*In terms of colours, older people need to be more stimulated. Pleasant colours. People are looking for nature.*" (P022EG).

"*I prefer an object.*" [...] "*Square or round. A rounded shape like a hoover.*" (A002EM)

"*I don't know if it adds anything because I've never worked with a robot. You're on a phone, you can interact, you don't need to have someone in front of you. You have text that appears and not everyone is able to see it, but if it's a voice saying the text that answers your question, that's something else. That would be enough for me. I don't need a man.*" (P025BMV).

"*I think he's really nice. I think it's fun and funny. And I love the yellow. It's the sun. If it's grey you'll get grey people in front of it. If you put something cheerful with sunshine, you'll get cheerful people. I think the bright side that represents it can only rub off on people.*" [...] "*I even think that some people will approach it more easily.*" (P013LJ)

2/ Opinions regarding the social robots in the hospital, advantages and drawbacks: most of the participants said that they would not be bothered by the presence of robots in the hospital as long as they are useful in this context and do not replace human professionals. Some people were against the presence of robots in the hospital because they only wanted to interact with other humans.

"*I prefer the human person. He's still a robot. It learns. It has to learn. It has to refine itself. I mean, the people behind it.*" [...] "*I wouldn't like to have a robot looking after me. I prefer a human being.*" (P008GC)

"*I don't need anything. I don't even need to ask him where to sit. But if it had been the first time, yes. It depends on the context in which you come to hospital. If you come every month you're familiar with it, but when you're new you don't know.*" (P009MMH).

"*I'm all for it as long as we don't have to take any blood.*" (P013LJ)

"*If it helps, I'm all for it, but not if it takes someone else's place.*" (A001LJ)

"*It doesn't bother me. The only thing that bothers me is that it takes people's jobs. But why not? It's like anything mechanical.*" (P018TD)

"*Yes, it can't be a solution for just anyone. If it's someone who can't manage on their own and needs help, or if it's someone who's become less able and comes to a machine on their own, it doesn't work.*" (P025BMV)

"*I've got nothing against it*." (A003GM)

"*I prefer a person to a robot, so I don't agree.*" (P029GA)

"*I don't mind. It could be useful. There are certainly functions that a robot can perform to help people who can no longer do certain things.*" (P030LM)

"*My fear is that it will replace humans. I think it can be good without replacing humans.*" (P031VG)

"I don't think it should be all alone in the middle of a room or at reception there should always be a human. (P033GG)

"*I'm not against it, but I don't see the benefit it would bring.*" (P035PC)

"*What I'd like from this robot is for me to go down to reception and say "Hello ARI, my name is XXX" "Go up to the first floor and you'll be seen by a nurse". That's what I'd like.*" (P039SJ)

3/ Opinions on the data collection and treatment made by robots: most people expressed concern about data protection. They accepted the idea of the robot collecting medical data as long as these data were properly stored and protected.

"I hadn't thought about that. It doesn't bother me, I don't care. But someone who doesn't like to be spied on or who has hidden things about their health or even their personalities from their family shouldn't let it leak out or be discovered." [...] "*That's not a problem as long as it's not archived and there's a minimum of security so that it can't be consulted by everyone. But I don't really see the point of keeping it. I'm not afraid of it, but I'm not for it.*" (P009MMH)

"*Recording, yes, but it shouldn't stay in the system indefinitely.*" (P013LJ)

"*It's a killer. If it's like mobile phones, you're no longer alone. You're recorded, even involuntarily, the phone listens to everything. There are keywords used to decipher things. Now you think of something and Google comes up with it without even saying it. You read something and you're bombarded with adverts, you think of something and Google bombards you. It's impressive. But I'm neither for nor against it. I have nothing to reproach myself for. I'm not afraid of these things*." (P018TD)

"*No, we don't know the future, we don't know what the people behind it are going to do with it.*" [...] "*The CNIL would have to be behind it. But there's no such thing as 100% security. There's always someone with bad intentions who could hijack things.*" [...] "*If they have the names and pathologies of the illnesses that people have.*" (P031VG)

"So either the robot doesn't have to respond to specific appointments. For example, someone comes in and says "It's 4pm, I've got an appointment with Mr So-and-so". So the robot has to be able to respond. "Ah, the person isn't free yet" but then we don't have to keep the answers with names." [...] "*It's not useful to keep them for long, and it can be a solution for not cluttering up the memory either. And at the same time it responds to people's requests.*" (P025BMV)

> "*It can be 6 months for someone who's ill and 15 days for someone who's not*." [...] *"It's important to keep a record so that you can go back in time. When someone is ill, you don't need to go back to find out what happened.*" [...] "*But not everyone has access to it. I'm thinking of hackers in particular. I know one personally and I know what he's capable of. They can get into a robot and take what they want. Information should be limited to the people concerned and to healthcare staff. After that, I wouldn't want my family to have access to what I've told the robot - it's none of their business. I wouldn't want to be beaten up in court to be declared under guardianship. Having lived through it, I know what people are capable of*." [...] "*Name and doctor and medical record don't bother me. What I would find intelligent is for the carte vitale to be secure and for the medical file to be on it. It shouldn't be stored on the robot but on an external server, but it should be super-secure, like the Banque de France. But I don't mind someone having access to my medical file rather than having to repeat it all the time*." (P013LJ).

> "*I don't know if it needs to [keep the information]. I don't know if he needs to [keep the information].*" [...] "*If it's for doctors, why not, but here it's for patients.*" [...] "*Maybe some data, especially the time of the appointment if there's a delay because I've already been waiting 30 minutes*." [...] "*Yes, after that he doesn't need to keep it. It's just information* (P029GA).

4/ Concern about the mistakes (bugs, accidents) that social robots might make/cause: Most of the participants were very concerned by the idea of the robot making mistakes. They thought that, in this case, the robot was useless.

> "*Robots can make mistakes, but so can humans. A surgeon messed me up a bit and now I've had the after-effects for three years. But if it had been a robot, maybe it would have gone better and I wouldn't have had any after-effects.*" [...]. "*He has no life, he doesn't think. So he does what we put in his head. He's programmed.*" (P030LM)

> "*I think that for people with a health problem it can destabilise them. They may say to themselves, "I'm not welcomed, I'm not given the information I need. I'm no longer taken into account as a human being.*" (P031VG)

> "*If he goes round in circles like that and can't tell me where to go. If he sends me to the cellar it's a bit embarrassing. Especially as I find it hard to walk. I'd get annoyed really quickly. I'd say to him "you're really too stupid, there's no point in putting you there. You shouldn't get paid". That would irritate and distu*rb me." [...] "*It would tend to irritate me and I wouldn't be very friendly.*" (P033GG)

> "*For the moment I haven't worried about it because I thought the robot shouldn't make mistakes. But if the robot makes mistakes it's a disaster.*" [...] "*We put it in to answer*

people's questions and if it answers incorrectly and sends them to the 3rd floor when the person is on the ground floor, it's a disaster. He's useless." (P035PC).

"*If he gets carried away there's no one else to replace him. The smallest mistake would worry me. If he's alone in the department and there's a technical problem, you'd have to wait for the technical department to replace him, but the patient is distraught and that creates a gap in terms of his safety and his medical care. It's an additional source of anxiety. If they can't find anything apart from the faulty robot, I don't really see the point*." (P018TD)

"*That can happen. They are programmed by a human being.*" [...] "*If it's badly done it will make mistakes.*" (P022EG)

"*Oh no, it's not serious, but losing data is. Personal information. We see too many dishonest things. There are little computer geniuses who manage to tamper with extraordinary things*. (A002EM)

"*It can happen. But we can't really answer that.*" [...] "*It would be annoying all the same. But we could have a service to report errors. But above all they shouldn't make any mistakes in identification or get the wrong files.*" [...] "*But yes, it's annoying for people who can't redirect themselves.*" (A004GM)

"*Given his speciality, I don't think he makes many mistakes.*" [...] "*But if it's "I've got an appointment at 10 o'clock" and* he *tells us "no, it's 11 o'clock" then yes, it can be annoying*."(P029GA)

"*It annoyed me*." [...] "*but it would have to be tested before being put into service.*" [...] "*It depends, for example, if someone has the same first name, middle name and date of birth. The robot mustn't confuse people. But it depends on the context.*" [...] "[for example, if the robot takes the person to the toilets instead of the toilets] *It would be "what an idiot, he hasn't understood a thing. Especially if I'm in a hurry.*" (P013LJ)

"*It's all going to depend on what's been put into his head. If it's fake news, frankly it scares the hell out of me.*" [...] *"And that it's being used knowingly to pass on bad information.*" (P004FM)

5/ Views regarding the possibility of having an emotional attachment to a robot: the participants had diverse opinions on this topic. Some participants thought that it was unlikely to get emotionally attached to a robot while others expressed concern about the possibility of an addiction to the robot especially if the person suffers from cognitive impairment.

"*No, I don't think so. There's a very good film about it. I can't remember the name. A guy fell in love with his computer. It's all fantasy. I find her charming, but no.*" [...] "[laughs] *It's an unfortunate reality that isolated elderly people can develop attachments.*" (P030LM)

"*He's already got a first name. If you work with him he can have a part of you, he's part of the family.*" [...] "*He has very beautiful eyes.*" (P031VG)

"*Attachment, yes, but it's up to him to empathise with me. Not attachment, but we can talk like with a girlfriend and if he has a bit of a sense of humour we can joke around.*" (P033GG)

"*No. Because affective bonds, as the word means affective, you have to have affection for a person, at the very least there are people who have affection for animals. But from there to loving a robot. Mind you, some people love their cars*." (P035PC)

"*Not even with the one you showed me. But a robot? Why not, I don't know, some people get attached.*" (P029GA)

"*Maybe people with cognitive problems*." (A003GM)

"*I think it's possible. You can get attached to a machine like you would a dog.*" (P028GM)

You get attached to something that gives you affection, the robot won't give you affection."(A004GM)

"*It's already happening in Japan, it's a projection of the human being. For lonely people.*" (A002EM)

"*Yes, I think you can. The fact that they're expressing something, you can see it in their faces, they have a lot of tenderness in their faces that attracts people. Maybe if it was an animal we'd detect something more surprising and reassuring. It's all very smooth. But here it's like a doll. It's normal.*" (P018TD)

"*No, we don't, but our children do. We know it's a machine, that's how we're formatted. Our grandson's a different matter, he's got a machine that tells him stories, no one tells us that he doesn't think it's his best friend.*" (P013LJ)

"It's really strange to me. We can be amused. We can find it funny, yes, but a link, no." [...] "*But we know it's a machine. I have no affection for my phone or my computer, so it's strange to me. I don't know about the others.*" (P009MMH)

"*I used to have a doll and I used to talk to it. Now it's a big doll, so it could be*." [...] "*It wouldn't be a friendship, it would be a friendship. I'd talk to her but it would be more for fun.*" (P008GC)

6/ Opinions on the risk of the replacement of the human being by robots: most of the participants had concerns about the risk that robots could replace human professionals. However, they expressed confidence on the fact that these robots would be kept for specific tasks under the supervision of humans.

"*You can never replace a human being. But the fact that we can manipulate them really raises questions in my mind. When I hear about, or read articles on, the famous social networks, I find it worrying that false images can be created. It's not always easy, when you don't know the subject, to realise that it's fake.*" (P004FM)

"*No, it needs to be improved. But it's worrying.*" (P008GC)

"*It's all very well for the reception, but if it takes the place of a human, no. If it does the tests, I'm not sure. If it does the tests, I say no. It scares me very, very, very, very much.*" (P009MMH)

"*When you see what the Japanese and Chinese are doing, it's worrying. There aren't enough of them, so they're replacing the missing people with robots. That worries me. Here in France, it's different. In some countries it is, I think. But I'm afraid that the robot will be powerful enough to repair itself. And I don't want that. It has to remain humans who repair robots. And that's where we are today in China.*" (P013LJ).

"*No, insofar as they replace them in a positive way. But if they go haywire and turn against us like in the movies, no.*" (P018TD)

"*Replacing in the open sea, yes. But I don't think it will replace it. But I know there was a soap opera about it, where the humanoids with the pretty plastic, who talked, traded, but that was science fiction.*" (P022EG)

"*Yes, they won't be able to cuddle, like a mother and child. You can't have that sort of thing with a machine.*" (A002EM)

"*It can't replace everything, but it can also be misleading because all young people are on the phone, tock, tock, tock. And that's what I did when I first got my phone, and immediately afterwards all sorts of things happened and I answered. I quickly realised that it wasn't possible. It was no good at all.*" (P025BMV).

"*No, because robots can only exist because of humans. And they don't reproduce.*" (P030LM)

"That's my fear. Having a robot that can simplify life and make improvements. But putting it in the place of a human, it dehumanises. Humans respond with emotions and feelings. And that takes jobs away." (P031VG)

"Humans will be intelligent enough not to put them everywhere." (P033GG)

"*I don't think they will replace humans. There are far more humans than robots. And they can replace humans in difficult and arduous tasks. And in a hospital, there are no difficult tasks. I'm thinking more of a garage. It's good that robots make cars. Robots that*

assemble and dismantle them. That's good. Hospitals are places where there have to be people. Carers are human." (P035PC)

"*I don't think robots will replace humans. [...] Because they have ready-made answers. There's no nuance in their answers; you get the impression that everything is programmed. [...] There's a lack of spontaneity, a lack of feeling. If someone comes to the robot completely livid, the robot won't see that they're in a bad way. It's going to leave behind past situations that could have serious consequences.*" (P039SJ)

3.3.2 Result Wave 2 experiment (Day Care Hospital - Real environment)

Period: September to december 2023

Socio-demographic data - Wave 2 (all participants)

A total of 49 volunteers took part in this evaluation.

Details of the recruitment procedure are given in section "*3.3 Specific description of each of the studies conducted in a real environment, patients and accompanying persons - Procedure*".

The socio-demographic data corresponding to the participants are presented in table 9.

Table 9. Socio-demographic data for participants in "Wave 2" - All participants (n=49)

Variables	Modalities	Total
Count	-	49 (100%)
Gender	Male	17 (34.69%)
	Female	32 (65.31%)
Profile	Patient	33 (67.35%)
	Accompanying person	16 (32.65%)
Age, years	*Min: 36* ; *Max*: 97 *Mean:* 73.89 y/o *SD*: 14.39	
Socio-educational level	*Min: 0*; *Max*: 15 *Mean:* 13,67 years *SD*: 2.95	

Results

Acceptability of the robot - Wave 2 (all participants)

This section presents the results obtained in the evaluation using the AES (Acceptability Scale). Figure 19 displays the total scores given by the 49 participants on the AES.

On this scale, only 41 participants answered all the questions. The 8 participants who did not respond were called for medical appointments and did not wish to continue the experiment.

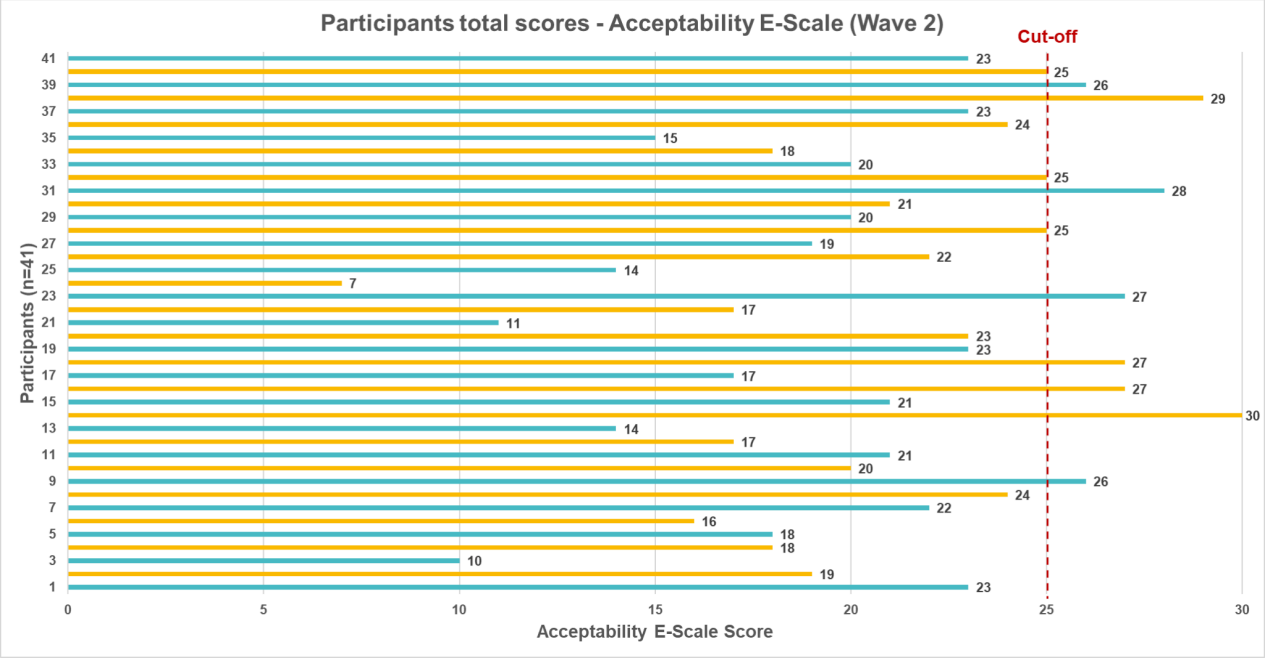


Figure 19. Acceptability E Scale Mean global scores in "Wave 2" – All participants (n=49)

Participants in the second wave obtained a mean total score of **20.85** (SD= 5.25) **out of 30**. The median for this sample was 21 out of 30. The threshold for acceptability of the E scale is set at 25 out of 30, indicating a level of acceptability slightly below acceptable, and ten participants reported a score above this threshold. The scores of participants in the second wave ranged from 7 to 30 out of 30.

36.59% of participants reported a score below 20, 39.02% between 20 and 25, and 24.39% above 25. Figure 20 shows the average scores for each dimension of AES for the entire second wave sample (n=41 participants).

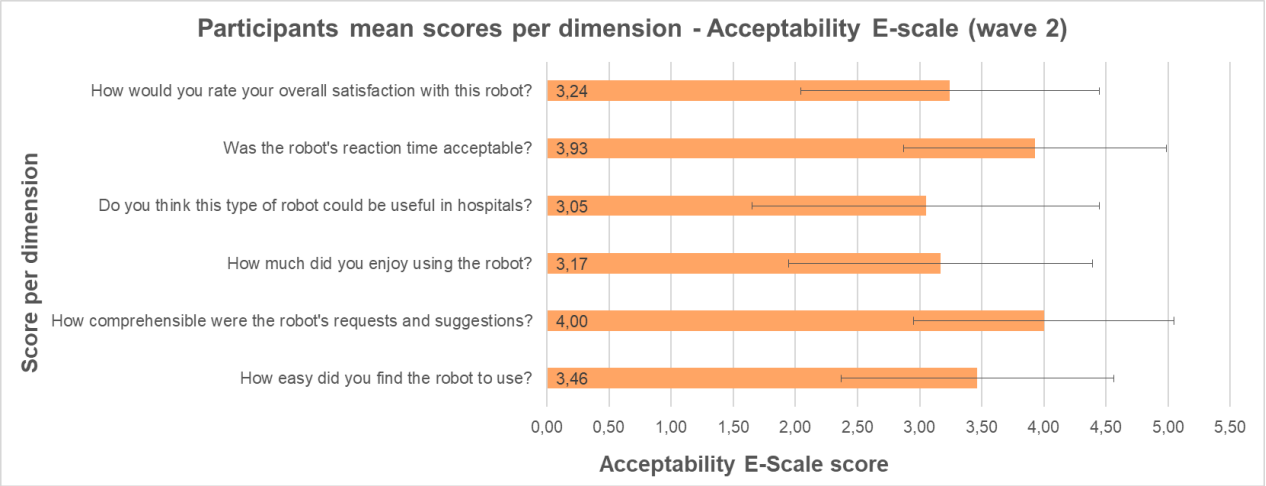


Figure 20. Acceptability E Scale scores per dimension in "Wave 2" - All participants (n=41)

Participants' scores on the various dimensions of the acceptability scale were fairly homogeneous, with higher scores for dimension 2 - robot comprehensibility (m=4; SD=1.05).

More average scores were reported for the other dimensions: dimension 1 - acceptability of the robot (m=3.46; SD=1.10), dimension 3 - pleasure in using the system (m=3.17; SD=1.22), dimension 4 - usefulness of the robot in the hospital (m=3.05; SD=1.40), dimension 5 - appreciation of the system's response time (m=3.93; SD=1.06) and dimension 6 - overall satisfaction with the system (m=3.24; SD=1.20).

In the following section, we provide an analysis of the participants 'verbatim associated with the questions about the acceptability of the robot.

Ease of use of the robot (AES): the participants noted that the robot was easy to use since they just had to ask questions and the robot would answer. However, they noted that the robot often gave inappropriate answers to their questions.

> "*Nothing works.*" (P049BM)

> "*I found his answer too long from the start. He's a machine, but you get the feeling he's reciting something. You don't feel like you're being received as a person. As far as I'm concerned, shorter answers are better. The person who comes, even if it's the support worker, doesn't need simple words.*" (A021LMA)

> "*Easy to use? Well, I didn't touch anything*." [...] "*Easy? Yes, it's easy. You just ask him questions and if the* question *is relevant he answers. So it's easy.*" (P074VMJ)

> "*Well, I didn't pass. So I certainly didn't understand it properly*." (P064DJ)

> "*Except that he answers completely out of turn but talking to him is easy*." (A009BDF)

Robot comprehensibility (AES): the participants could understand the robot very well. They noted that they were helped by the text displayed on the robot. However, they noted that the answers of the robot were too long and sometimes inappropriate.

> "*So what he said was very clear, when he spoke it was clear, it was he who didn't understand us. What's more, when he understood the question, he gave us a lot of information that we didn't even ask him for.*" (A008BT)

> "*We didn't understand a thing. It seemed to me that he spoke clearly. No, we could understand him but uninteresting.*" (P049BM)

> "*Given that I could read, it made things easier for me.*" (P051HJ)

> "*It depends on the questions, in fact. In other words, there were questions where he answered very well, and there were questions where he answered a bit off the mark. There was one moment when he got it a bit wrong, but apart from that, the other [answers] were fine. I mean, he answered most of the questions pretty well.*" (A010LB)

> "*Well. They were quite understandable but much, much too long.*" (A021LMA)

Enjoyment in using the system (AES): the opinions of the participants were diverse. Some participants said that they enjoyed the interaction with the robot because they had fun. Others did not enjoy the interaction because they do not like to interact with a rabot rather than with a human being.

> "*Very nice, I give it 5 [out of 5].*" (P047BLM)

> "*The voice recognition doesn't work well but it's not very difficult to improve.... I think.*" (A008BT)

> "*Ah bah it hasn't been useful at all because I don't need anything.*" (P049BM)

> "*I took it as a game.*" (P086MC)

> "*I would have preferred a human being to a robot. I'm always impressed when I have to deal with a machine that responds to a certain logic that's introduced into it, and which won't always respond to what I'm expecting.* [...] *They put computers on trains, they put them everywhere. All of a sudden it bugs. There should never be any problems, but suddenly there are.* [...] *The computer has been programmed to do something very specific. If it ever goes beyond the programming, it's ruined. If, for example, I don't know that it's a robot, I can tell myself that it's someone who talks. But we're going to have to find something that's closer to human, so that we have an illusion, that we're almost talking to a human.*" (P051HJ)

"*...Can't say I enjoyed it. It's fun though.*" (P050BF)

Usefulness of the robot's responses (AES): the participants thought that a robot could be useful for various tasks in a hospital. However, the robot was not mature enough to help them efficiently**.**

"*He didn't answer my questions and I thought, am I going too fast? and that was it.*" (P047BLM)

"*Ah well, it wasn't useful at all because I don't need anything.*" (P049BM)

"*If it's properly programmed, it could be useful. For the moment, there's a lot of progress to be made on that.*" (P051HJ)

"*Ah well, for orientation, that's for sure. Except when he didn't know, but I think that's a question of programming.*" (A010LB)

"*Well, he did the job all the same.*" (A017MM)

"*The simple question, is there a toilet nearby? I thought it was a simple and essential question, but then they tell me it's not us, I can't arrange appointments with doctors. It was completely unsuitable and yet, well, I don't think I asked it in a complicated way.*" (A021LMA)

"*The answers are... it's common sense but at the daisy level*" (P054LMJ)

"*Oh yes, that. That's useful. That's a help, especially for a hospital like this.*" (P086MC)

"*... Except for the cafeteria he didn't teach me anything else.*" (P050BF)

Appreciation of the robot's response time (AES): the answers of the participants were diverse. Some participants said that the robot answered quickly. Others thought that it was too slow to answer.

"*It was quick.*" (A010LB)

"*Yes, when he's understood the question, he answers straight away. Then he has a problem with the blank timer, he has to detect a blank in a maximum of a second and a half before saying I'm stopping listening.*" (A008BT)

"*I found that I spent far too much time answering to say useless things.*" (A021LMA)

"*Maybe it's the time lag. He wasn't answering my questions. And I thought, am I going too fast?* [...] "*That's right, in real time I would have gone to the secretary to ask her how things were going*". (P047BLM)

"*He replied immediately*." (P078CMJ)

"*I found it a bit slow because I tend to speak too quickly. So he didn't have time to answer the question. He gets confused by what I tell him.*" (A009BDF)

"*I don't find it very useful. A screen would have been enough for me. It would have been quicker anyway. I think it's slow.*" (P054LMJ)

Overall satisfaction with the robot (AES): The opinions were diverse. Some participants said that they were satisfied with the robot which had potential after some adjustments. Others said that they were not interested in robots.

"*So, I'm sure it has potential, it's not working well today, there are adjustments to be made* [...] *but it has potential, that's for sure.*" (A008BT)

"*I'm not interested in your robot.*" (P049BM)

"*I found that I spent far too much time answering to say useless things.*" (A021LMA)

"*It's annoying what I'm about to tell you because I thought it was fun, so it's silly.*" (P073GY)

"*Well, he did the job anyway.*" (A017MM)

"*Well, for the moment it's not much, is it? A bit satisfied.*" (P051HJ)

Acceptability of the robot - Wave 2 (Patients)

Patients in Wave 2 reported a mean total score of **20.79** (SD=5.90) **out of 30**. The median for this sample was 22 out of 30. The threshold for acceptability of the E scale is set at 25 out of 30, indicating a level of acceptability below the acceptable, and 9 patients reported a score above this threshold. The scores of participants in the first wave ranged from 7 to 30 out of 30.

37.94% (n=11) of patients reported a score below 20, 31.03% (n=9) between 20 and 25, and 31.03% (n=9) above 25. Figure 21 shows the average scores for each dimension of AES for the entire first wave sample (n=29 patients).

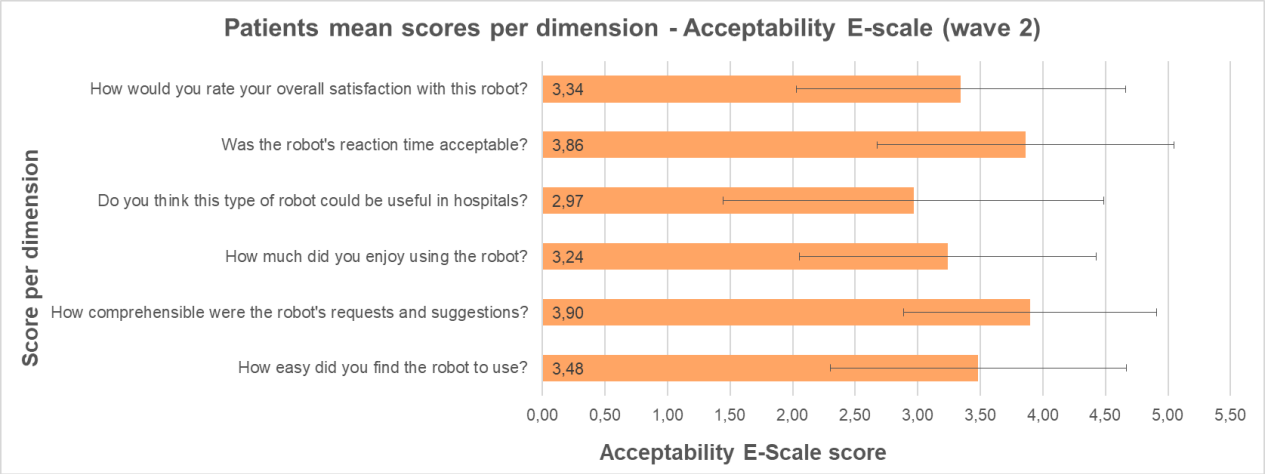


Figure 21. Acceptability E Scale scores per dimension in "Wave 2" - patients (n=29)

Patients' scores on the various dimensions of the acceptability scale were fairly homogeneous, with higher scores for dimension 2 - robot comprehensibility (m=3.90; SD=1.01).

More average scores were reported for the other dimensions: dimension 1 - acceptability of the robot (m=3.48; SD=1.18), dimension 3 - pleasure in using the system (m=3.24; SD=1.18), dimension 4 - usefulness of the robot in the hospital (m=2.97; SD=1.52), dimension 5 - appreciation of the system's response time (m=3.86; SD=1.19) and dimension 6 - overall satisfaction with the system (m=3.34; SD=1.32).

Acceptability of the robot - Wave 2 (Accompanying persons)

Accompanying persons in Wave 2 reported a mean total score of **21** (SD=3.38) **out of 30**. The median for this sample was 21 out of 30. The threshold for acceptability of the E scale is set at 25 out of 30, indicating a level of acceptability below the acceptable, and 2 patients reported a score above this threshold. The scores of participants in the first wave ranged from 15 to 30 out of 30.

33.33% (n=4) of accompanying persons reported a score below 20, 50% (n=6) between 20 and 25, and 16.67% (n=2) above 25. Figure 22 shows the average scores for each dimension of AES for the entire first wave sample (n=12 accompanying persons).

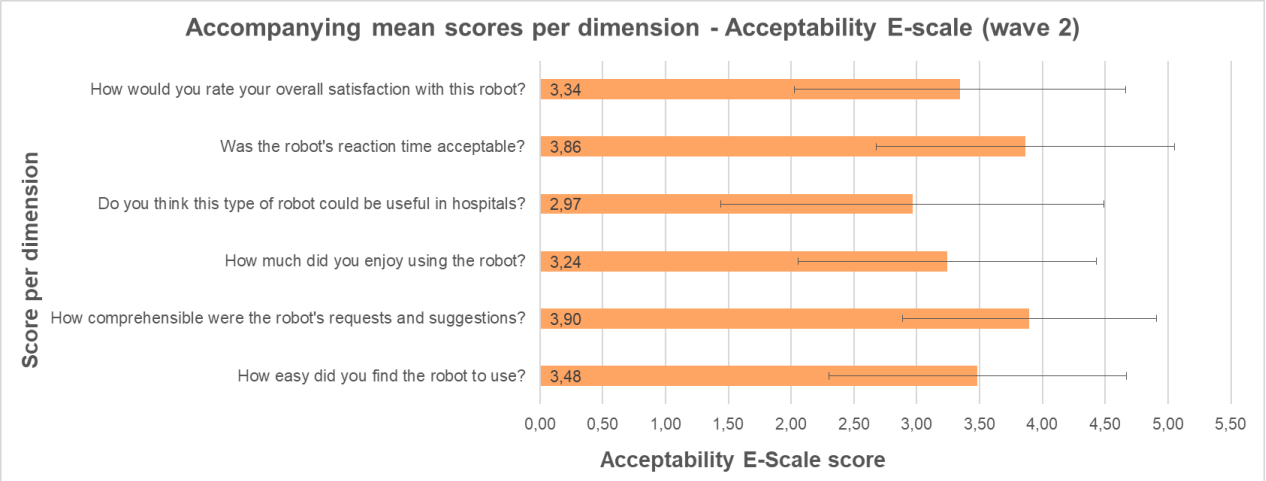


Figure 22. Acceptability E Scale scores per dimension in "Wave 2" - Accompanying persons (n=12)

Accompanying person's scores on the various dimensions of the acceptability scale were fairly homogeneous, with higher scores for dimension 2 - robot comprehensibility (m=4.25; SD=1.14).

More average scores were reported for the other dimensions: dimension 1 - acceptability of the robot (m=3.42; SD=0.90), dimension 3 - pleasure in using the system (m=3; SD=1.35), dimension 4 - usefulness of the robot in the hospital (m=3.25; SD=1.06), dimension 5 - appreciation of the system's response time (m=4.08; SD=0.67) and dimension 6 - overall satisfaction with the system (m=3; SD=0.85).

Usability of the robot - Wave 2 (All participants)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 2, participants reported a mean score of **57.03** on the SUS scale (SD=22.88; med=62.5), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

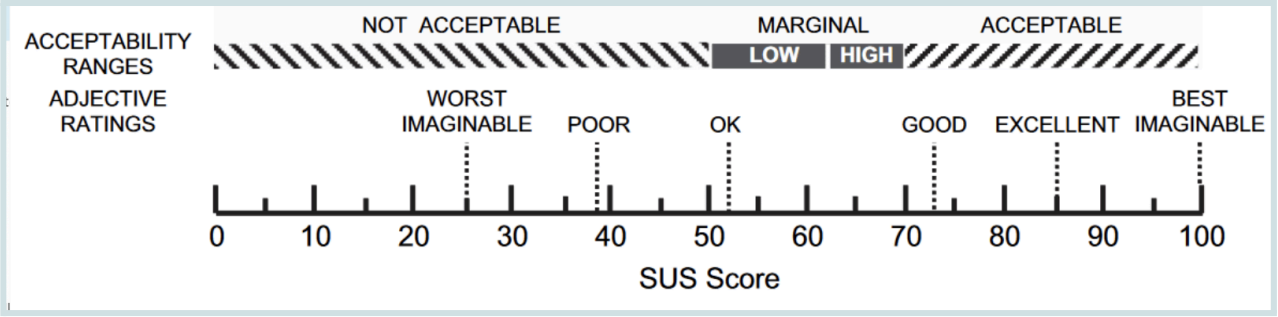


Figure 23. SUS scale acceptability rank

Figure 24 presents the scores given by the 43 participants on the SUS usability scale.

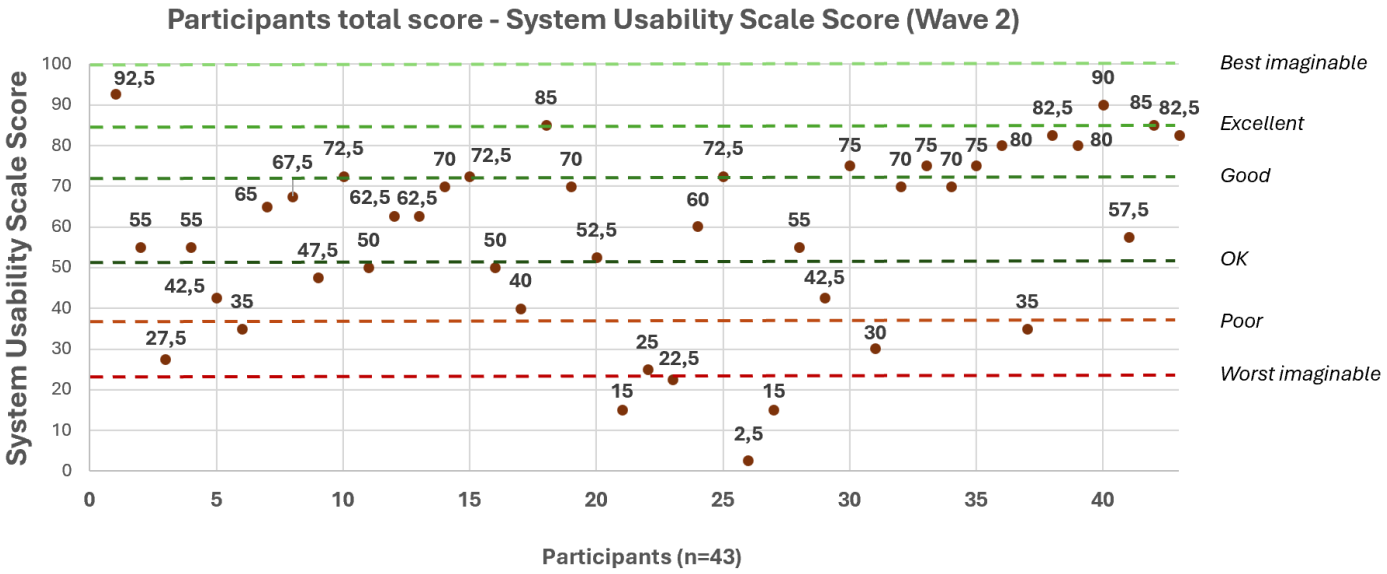


Figure 24. System Usability Scale Mean global scores in "Wave 2" – All participants (n=43)

The table 10 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 10.** System Usability Scale scores per dimension in "Wave 2" - All participants (n=43)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.05	1.13	0	4
2) I find the system unnecessarily complex.	2.37	1.33	0	4
3) I think the system is easy to use.	2.63	1.11	0	4
4) I think I would need the help of a technically skilled person to use this system.	2.21	1.50	0	4
5) I found the various functions in this system to be well integrated.	2.37	1.00	0	4
6) I think the system has too many inconsistencies.	2.44	1.35	0	4
7) I imagine that most people would learn to use this system very quickly.	2.53	1.16	0	4
8) I found the system very difficult to use.	2.23	1.51	0	4
9) I felt very confident using this system.	2.51	1.26	0	4
10) I think there is a lot to learn before one can effectively use this system.	1.77	1.44	0	4

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Qualitative feedback given by the participants regarding the usability assessment is presented below.

I'd like to use this robot in hospital as often as possible (SUS)

> "*I prefer humans, but I prefer robots to nothing.*" (A008BT)

***I find conversations with this robot unnecessarily complex (SUS)**:* These participants expressed varied perspectives on the ease with which different user groups could learn to use the robot. Some point to specific challenges linked to age and the complexity of the robot's responses, while others are more confident in their personal ability to adapt, recognizing however that the experience can vary significantly depending on the audience.

> "*It's true that he gave a lot of information, but he's going to learn to be a bit more precise in his answers, I think it's true that it's a bit complex. A human being who has a person in front of him needs a lot more information. He needs to learn a bit, but he'll end up learning because we can do that today. He needs to learn a bit more in the context of how far he should go in the conversation, but he started saying that it was on the first floor and then he started saying that if I had any questions, I should ask on the ground floor. We should be able to sort it out, but he has potential*." (A008BT)
>
> "*Sometimes he doesn't really understand the questions.*" (P050BF)
>
> "*Sometimes he digresses a bit, you could say.*" (A010LB)

I think this robot is easy to use (SUS)

> "*ah! Not today.*" (A008BT)
>
> "*well, it doesn't work for me.*" (P049BM)

I think I'll need help to be able to interact with this robot (SUS): The participants express the technical difficulties encountered by the experimenters, indicating that external interventions, such as restarts or relaunches, are necessary for effective interaction. This need for technical assistance reflects current challenges in device reliability.

> "*In the current version yes, absolutely, because you have to reboot it, you have to relaunch it and so on*". (A008BT)
>
> "*Well if it doesn't work surely, that's the case at the moment.*" (P049BM)

I thought the robot's various services were well thought out (SUS): Comments reflect a variety of opinions on the scope and effectiveness of the services offered by the robot. One user recognizes the positive intention behind the design of the services, but notes that the expected

results have not yet been achieved, while another highlights a lack of diversity and breadth in the services available, indicating a need for improvement.

> "*There is clearly a desire to. But the results aren't there yet.*" (A009DBF).

> "*But for them, there aren't many services. There are too few services. Insufficient service.*" (P054LMJ)

I think there are too many inconsistencies in this robot (SUS)

> "*Voice recognition doesn't work very well, but once he recognised it, we saw how he spoke. So only once but still.*"(A008BT)

I imagine that most people would be able to learn to use this robot very quickly (SUS): These user reactions highlight that the ability to quickly learn to use the robot can vary significantly depending on age and context, with particular concerns expressed in a geriatric care environment. Some note challenges related to the complexity of the robot's responses and its ability to understand questions, while others feel that their own adaptability would not be a problem.

> "*People of my generation, and as this is the majority here, it's older people.*" (P051HJ)

> "*Because he doesn't understand much and he answers too complicated.*" (A021LMA)

> "*I don't know, I know that, for me, it wouldn't be a problem. I don't know if it would be I would say that in the current state he's in, because we're in a very gerontological department. I think very clearly that there will be a difference depending on the audience.*" (A009DBF)

> "*Most people are in geriatric care. It may be more complicated.*" (P053ML)

I found it very difficult to talk and behave naturally with this robot (SUS): Various user reactions were obtained to the need to adapt in order to interact naturally with the robot. Some felt no discomfort in communicating with a machine, while others adjusted their behavior to compensate for the robot's comprehension limits, particularly when they had difficulty making themselves understood.

> "*No, it didn't bother me too much that it was a machine.*"(P049BM)

> "*When I saw that he didn't understand what I was saying, I had to explain more clearly what I was doing that wasn't natural, so I reacted according to the way he worked. [I changed my behaviour.*" (A009DBF)

> "*I haven't even thought about it.*" (P052BDBC)

"*Yes, that's true. At least for me, since it's the first time. Then maybe I'll go back to kissing and everything.*" (P053ML)

I felt very confident using the robot (SUS): *These responses reveal an evolution in the level of trust felt by users towards the robot. One expresses moderate agreement, noting that his confidence could increase with more precise answers, while the other describes a process of adaptation, starting from initial skepticism to gradual acceptance.*

"*Oh no. Moderately agree, but I could trust him if he was a bit more precise in his answers and all that, there's still work to be done.*" (P051HJ)

"*We're dubious at first, and then it gets better. So it's 'average'. At first you're sceptical and then you get used to it.*" (A010LB)

I think there's a lot to learn to use this robot properly (SUS): These testimonials offer varied perspectives on the learning requirement for mastering robot use. One user perceives a slight learning curve, while another does not think that using the robot requires extensive learning, but recognizes that this perception may not be shared by all.

"*Disagree. Maybe a bit of a learning curve.*" (A010LB)

"*I don't think so, but it's a bit like duplicating help. That's it for me, no, but I'm not sure that's the case for everyone.*" (A009DBF)

Usability of the robot - Wave 2 (patients)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 2, patients reported a mean score of 57.42 on the SUS scale (SD=57.42; med=61.25), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 11 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 11.** System Usability Scale scores per dimension in "Wave 2" - patients (n=49)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.03	1.27	0	4
2) I find the system unnecessarily complex.	2.47	1.31	0	4
3) I think the system is easy to use.	2.77	1.17	0	4

4) I think I would need the help of a technically skilled person to use this system.	2.13	1.55	0	4
5) I found the various functions in this system to be well integrated.	2.43	1.10	0	4
6) I think the system has too many inconsistencies.	2.47	1.28	0	4
7) I imagine that most people would learn to use this system very quickly.	2.40	1.28	0	4
8) I found the system very difficult to use.	2.37	1.50	0	4
9) I felt very confident using this system.	2.40	1.33	0	4
10) I think there is a lot to learn before one can effectively use this system.	1.50	1.41	0	4

Usability of the robot - Wave 2 (Accompanying persons)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 2, accompanying persons reported a mean score of 58.65 on the SUS scale (SD=17.04; med=62.50), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 12 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 12.** System Usability Scale Scores per dimension in “Wave 2” - Accompanying persons (n= 29)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.08	0.76	1	4
2) I find the system unnecessarily complex.	2.15	1.41	0	4
3) I think the system is easy to use.	2.31	0.95	1	4
4) I think I would need the help of a technically skilled person to use this system.	2.38	1.45	0	4
5) I found the various functions in this system to be well integrated.	2.23	0.73	1	4
6) I think the system has too many inconsistencies.	2.38	1.56	0	4
7) I imagine that most people would learn to use this system very quickly.	2.85	0.80	1	4
8) I found the system very difficult to use.	1.92	1.55	0	4

9) I felt very confident using this system.	2.77	1.09	1	4
10) I think there is a lot to learn before one can effectively use this system.	2.38	1.39	0	4

Semi Structured interview on the ethical dimension - Wave 2

This section presents the main opinions given by the participants regarding the ethical issues addressed in the semi-structured interview (see annex 4). Some participants' verbatims were extracted from the interview transcripts and used to illustrate different views.

1/ Opinions regarding the development and use of robots with human-like appearance (humanoids)

"*Well, I admit it's true that it can be confusing at first.*" (P053ML)

"*Because robots are from another planet. So I find that the resemblance is better if they're badly made, which we don't know. But a robot that looks like a human, no. Personally, I'd rather have a monster.*" (P048MF)

"*I don't mind, but I'd prefer it to look like something else.*" [...] "*It looks like a robot.*" [...] *"I don't know. I wouldn't be so keen on a monster. The fact that it's something human makes it easier to talk to and identify with. I'd rather talk to that than a box like ALEXA or something like that. Features make it easier to talk to, rather than an unidentified form*." *(*A006CP)

"*I like the fact that it's a human representation.*" (A007CR)

"*The design isn't bad, but it's a shame there's the screen. If you want to replace a relationship with a human being, it's still a television." [...] "It's a little more user-friendly and less repulsive. We're more inclined to go there than when it's a square. After all, it doesn't replace the relational aspect, but it's easier when it's a human form than when it's a square*." (A010LB)

"No. There's no need for that. All you need is a screen and that's enough. Interaction is about voice, not appearance. I think it's horrible to look at. I think it's too bulky. You get the impression you're in a cartoon. It doesn't fit. I don't know, it's not for adults. First of all, it's too big. And what's the point of looking like that on a woman? I find it infinitely ugly? Anyway, that's my personal aesthetic." (P054LMJ)

"I don't think so. Because I think it's introducing... It's an absence of factual reality and I'm totally against it. [...] *In other words, a human is a human, and a robot is a machine*." (P071HA)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Other participants are in favour of robots that look like humans, valuing the identification and psychological comfort that this can bring, particularly in sensitive contexts such as hospitals :

> *"Oh well, he's got a nice little face."* (A022CJP)

> *"Well, if that's what it is, yes. I think it's relatively neutral. He's got the right tone, he's not smiling like an idiot, he's not dramatic."* (P085LAM)

> *"Yes. Because we don't seem to be with a robot."* (P047BLM)

> *"It depends on the context. In a hospital, yes, so as not to frighten the children."* (P049MS)

For some, the appearance of robots is secondary to their functionality. These participants prioritise the performance and usefulness of the interactions rather than the external appearance :

> *"To tell the truth, for me it's not very important that they look like humans. Because I don't identify with them, it's the answers they give me that really matter to me"* (A027NH)

> *"I don't know, I don't have an answer, black or white, well in general anyway. I think that ... it's not very interesting that it's, that there's anthropomorphism I think. It could be something like R2D2 or something more fun. The fact that it's a humanoid form, it's a way of getting closer to being human while still not being human. And it's not necessarily reassuring, it's not worrying, but it's not reassuring."* (P066AT)

2/ Opinions regarding the social robots in the hospital, advantages and drawbacks

This section explores participants' views on the deployment of social robots in hospital settings, highlighting a balance between the practical benefits and the potential loss of human contact.

Some participants see the usefulness of robots, appreciating the assistance they can provide in understaffed situations:

> "*I think it's useful. And besides that, maybe for some people it scares them.*"(P047BLM)

> "*But there are plenty of things to do in hospitals, so why not?*" (A008BT)

> "*If it can help and be effective, especially during the night when staff are short, why not.*" (A007CR)

Others express concern about the reduction in human contact, which they value highly:

> "*I don't approve.*"

> *"I don't approve. I say why not, but we're losing human contact.*" (A006CP)

> " *It doesn't shock me, because it's an interaction that can be easier.*" (P048MF)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

3/ Opinions on the data collection and treatment made by robots

This section deals with participants' views on the ethical implications of robots collecting and storing personal information, a key aspect of data privacy and security.

Participants expressed mixed feelings about data privacy and the implications of robots managing personal information. Some expressed the fact that they have nothing to hide and that the robot can have access to all the information. Others added that the hospital's computers also handle their personal data and that the robot is just another computer :

> "*I don't mind it. I'm of a certain age, and I don't see what I'd do with it*." (P047BLM)

> "*Me, I'm very naive and very benign, so I'd say it doesn't bother me.*" (A026NS)

> "*Yes, given the type of information it gives, it's necessary to keep.*" (A008BT)

> "*That is to say that there, in fact it's the same, we're obliged to trust the hospital for example, there, when we're recorded and entered into the computer, we're obliged to trust, that they're not going to divulge our information.*" (A011RMA)

Other participants, on the other hand, expressed doubts about the circulation of their personal information, particularly outside the hospital :

> "*The data is likely to be the property of the company that manages the robot.*" (A006CP)

> "*No, all this manipulation should be avoided as far as possible.*" (A023AG)

> "*Yes, in terms of studies, yes. But then, where this information goes is another matter*." (P048MF)

> "*It worries me insofar as the data can be misused.*" (P088LA)

4/ Concern about the mistakes (bugs, accidents) that social robots might make/cause

This section explores participants' views on the potential mistakes that social robots could make and their impact.

Some participants do not see any major risk and feel that mistakes can be controlled or are inevitable but not serious:

"*I'll tell you one thing, there are already doctors who are already... For example, remote medicine. There's a lot of stuff attached to robots. Diagnosis is an error.*" (P051HJ)

"*Even if the error is human, I think I'll always have more confidence in man.*" (P053ML)

"I'd tend to think it makes fewer mistakes than a human anyway." [...] "*It's true that a human can be tired and tell you it's this way when it's not and it's true that the robot if the engineers integrate certain information normally there you go, so from an informational error and orientation point of view there are no problems.*" (P049BM)

"*Yes, just as an EXCEL spreadsheet doesn't make mistakes when you ask it to add up.*" [...] *"If he takes me to the bar instead of the toilet, fine. There are acceptable mistakes, and unacceptable mistakes.*" (P048MF)

"*If he takes me to the bar instead of the toilet, then fine. There are acceptable mistakes, and unacceptable mistakes.*" (P064DJ)

Well, you have to trust him. No, well, if there was a mistake, I think we'd detect it beforehand, wouldn't we?" (P073GY)

"*As far as I'm concerned, there hasn't been any intelligence error yet, because in any case I had someone, a human being, at the end of the half-day.*" (P063GM)

"*I don't know if he can make mistakes, but I suppose he can.*" (P074VMJ)

"*Of course. It can lead to erroneous conclusions*." (P054LMJ)

"*It depends how much control we have over the robot. What are the safeguards?*" (P088LA)

"*That's right, because we can't get certain things right with robots.*" (A026NS)

"*From what I can imagine, there can't be much of a mistake. But you never know.*" (A017MM)

5/ Views regarding the possibility of having an emotional attachment to a robot

This section discusses the ability of robots to make emotional connections with humans, and whether participants think it is possible to develop emotional bonds with them.

"*Not at all. Because affection is something to do with being human. And it's not done, I'm past the transitional object stage.*" (P054LMJ)

"I remember those little robot dogs, I know there are people who have really developed an emotional bond. So when you have a dog or family around, you're not looking for an

emotional bond with a robot. I think it depends on your life. Yeah, the state of mind you're in, the need you might have for a relationship." (P052BDBC)

"*There are some who get affection from it. From what I've read in Japan, they're very advanced in this area*." [...] "*So I say be careful, I mean, there are barriers to be put up, I think.*" (P055RD)

"*An emotional relationship means having a long-term relationship. And if it's just asking where the toilet is, when you go to hospital once in a while...*" (P073GY)

"*It's no longer medicine at that point, fundamentally it's a relationship.*" (P085LAM)

6/ Opinions on the risk of the replacement of the human being by robots

This section examines participants' concerns about the possibility of social robots replacing humans in certain roles or jobs.

Some participants are concerned about social robots replacing humans, fearing job losses or dehumanisation of services:

"*Yes. Because I'm an older adult and I can see it happening.*" (P088LA)

"*It worries me to the extent that people are being replaced by machines.*" (P074VMJ)

"*Ah, that would be dramatic. Yes, unfortunately.*" (P086MC)

"*There's also the question of the humanity of these services*." (A011RMA)

Other participants think that robots will not be able to completely replace humans, believing that human intervention will always be necessary:

"No, because I see the robot as complementary." (P048MF)

"*Yes, there's always a human behind it, so I don't mind.*" (A006CP)

"*Let's just say that I have a sufficiently optimistic background to believe that humans will remain indispensable.*" (A017MM)

"*No, they won't.*" (P049BM)

3.3.3 Study 2: Wave 3 experiment (Day Care Hospital - Real environment)

Period: march to may 2024

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Socio-demographic data - Wave 3 (all participants)

A total of 23 volunteers took part in this evaluation.

Details of the recruitment procedure are given in section "*3.3 Specific description of each of the studies conducted in a real environment, patients and accompanying persons - Procedure*".

The socio-demographic data corresponding to the participants are presented in table 13.

Table 13. Socio-demographic data for participants in "Wave 3" - All participants (n=23)

Variables	Modalities	Total
Count	-	23 (100%)
Gender	Male	6 (26%)
	Female	17 (74%)
Profile	Patient	16 (70%)
	Accompanying person	7 (30%)
Age, years	*Min: 49*; *Max*: 94 *Mean:* 77.83 y/o *SD*: 10.73	
Socio-educational level	*Min: 0*; *Max*: 15 *Mean:* 12.01 years *SD*: 4.38	

Results

Acceptability of the robot - Wave 3 (All participants)

This section presents the results obtained in the evaluation using the AES (Acceptability Scale). Figure 25 displays the total scores given by the 22 participants on the AES.

On this scale, only 22 participants answered all the questions. Participant who did not respond were called for their medical appointments and did not wish to continue the experiment.

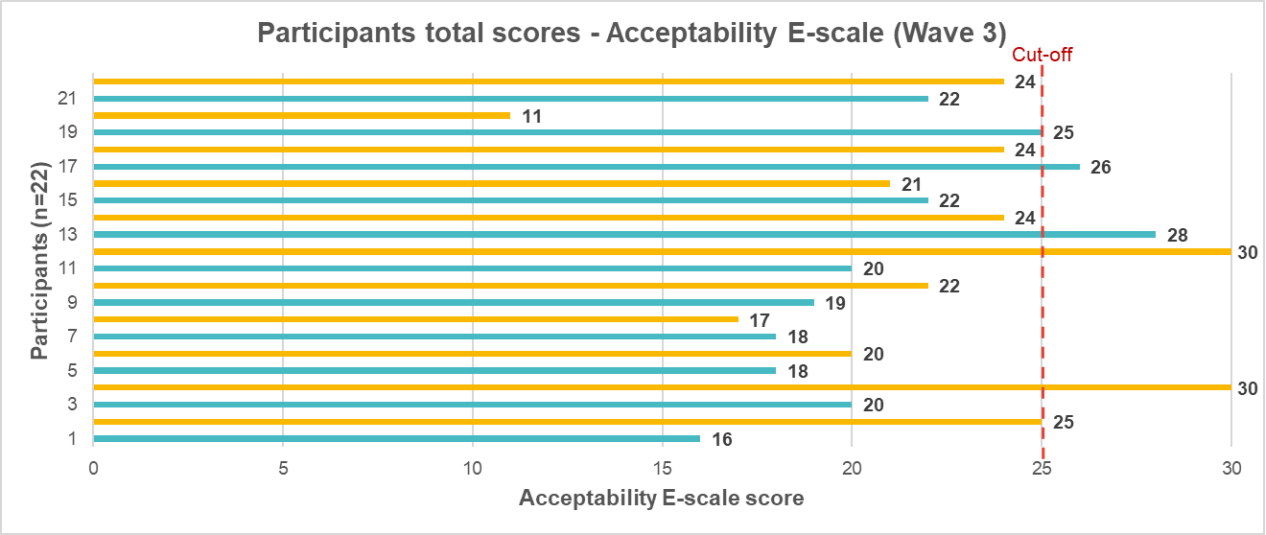


Figure 25. *Acceptability E Scale Mean global scores in "Wave 3" – All participants (n=22)*

Participants in Wave 3 reported a mean total score of **21.91** (SD=4.61) **out of 30**. The median for this sample was 22 out of 30. The threshold for acceptability of the E scale is set at 25 out of 30, indicating a level of acceptability below the acceptable. As a reminder, the cut-off threshold, represents the acceptance threshold for commercial products. ARI being an experimental platforms, the scale is still relevant, but the interpretation of the threshold must be done with care. Six participants reported a score above or equal to this threshold. The scores of participants in the first wave ranged from 11 to 30 out of 30.

27.27% (n=6) of participants reported a score below 20, 45.46% (n=10) between 20 and 25, and 27.27% (n=6) above 25. Figure 26 shows the average scores for each dimension of ARS for the entire first wave sample (n=22 participants).

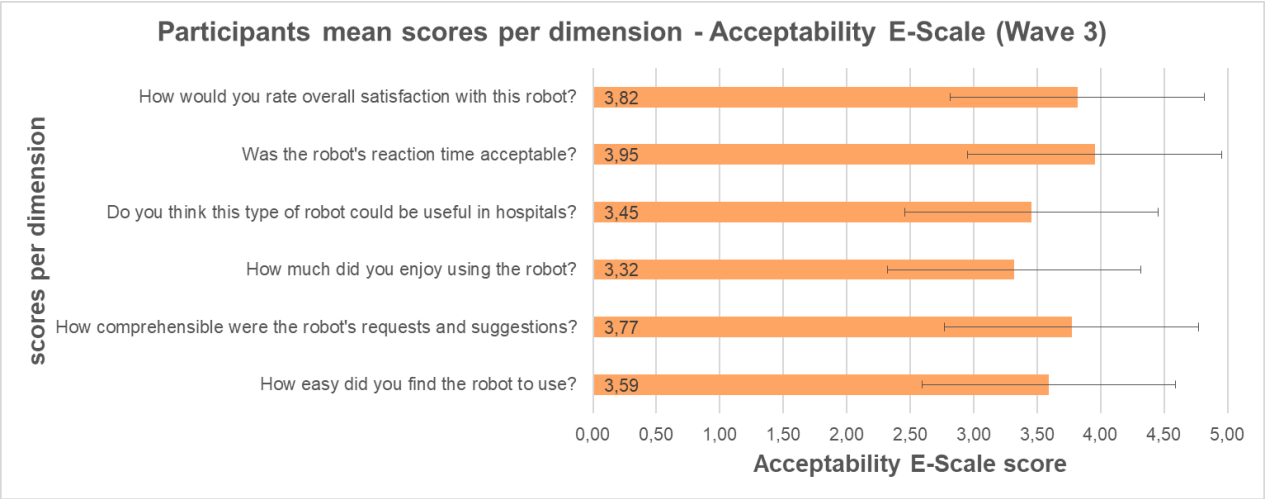


Figure 26. Acceptability E Scale scores per dimension in "Wave 3" - All participants (n=22)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Participants' scores on the various dimensions of the acceptability scale were fairly homogeneous, ranging from 3.32 to 3.97/5. Description of scores:
dimension 1 - acceptability of the robot (m=3.59; SD=0.91), dimension 2 - robot comprehensibility (m=3.77; SD=1.17), dimension 3 - pleasure in using the system (m=3.32; SD=0.95), dimension 4 - usefulness of the robot in the hospital (m=3.45; SD=1.14), dimension 5 - appreciation of the system's response time (m=3.95; SD=0.95) and dimension 6 - overall satisfaction with the system (m=3.82; SD=0.73).

In the following section, we provide an analysis of the participants 'verbatim associated with the questions about the acceptability of the robot.

Ease of use of the robot (AES): the following comments reveal a variety of user perceptions of the robot's ease of use, highlighting both positive experiences and challenges encountered when interacting with the machine.

> "*Yeah, it's easy to use.*" (A027NH)

> "*That's the obstacle, it's that we're talking to a machine and then as I told you, these answers are ... or didn't rephrase ... I have to rephrase my question or the answer is a bit long. And I don't know where I stand anymore*." (A025BN)

> "*It depends on the questions, it depends on the answer too.*" (P091NCH)

Robot comprehensibility (AES): feedback on comprehensibility illustrates generally positive reactions to the clarity and precision of the answers provided, particularly in a hospital context.

> "*That's understandable.*" (A025BN)

> "*Yeah, well, I'd say it's good. No, it was actually quite precise.*" (P098BM)

> "*Yes, yes, yes. Yes, it's very understandable, yes, yes, yes*." (P096BCR)

> "*It's a language that's simple all the same, and what's needed is what's needed. I think, especially in a hospital like this. He answers simply*." (P094BM)

Enjoyment in using the system (AES): these comments reflect the varied attitudes of users to the idea of using the robot frequently. Some participants are in favor of using this robotic device in hospital frequently, while others are more technology-phobic, preferring to interact directly with a human.

> "*I'm against it at the moment. Maybe over time, you know, I always say to myself that it was better before in many areas. So it's true that for me, robots, as I explained earlier, are*

like new technologies and all that. I have a phobia like an administrative phobia." (P092SA)

"*It's true that where he was able to answer he was there, so apart from the fact that each time he sent me back to reception, but well.* [...] *he won't necessarily give bad information because he's trained to give good information.*" (A025BN)

Usefulness of the robot's responses(AES): the impressions gathered below illustrate the debate between preference for human interaction and appreciation of the reliability of robot responses, highlighting a diversity of perspectives on the effectiveness of automated assistance.

"*I prefer human.*" (P090GM)

"*It's true that where he was able to answer, he was there, so apart from the fact that each time he referred me to the reception desk, but*" [...] "*he won't necessarily give bad information because he's trained to give good information*." (A025BN)

Appreciation of the robot's response time (AES): participants highlight users' perceptions of the robot's response time, oscillating between frustration with expectations of speed and personal challenges in terms of question formulation, illustrating the different reactions to the speed with which the robot processes queries.

"*I had the impression that I wasn't asking the right questions. And that inevitably they didn't understand what I was saying, so I put that down not to his fault, but to mine.* [...] *he didn't understand what I was saying. So maybe it was my way of expressing myself or maybe I'm just not used to it. I'm not familiar with robots.*" (P092SA)

"*So? I'm here in an experimental setting so I'm playing along. I know I'm coming, I'm anxious, I'm... I'm in a hurry, et cetera. Maybe he'll get on my nerves a bit and someone who's not necessarily patient, he'll get a bit annoyed and then say 'Well, who's going to answer me because he's starting to piss me off', maybe a bit too slow.*" (A025BN)

Overall satisfaction with the robot (AES): testimonials on overall satisfaction reflect a generally positive appreciation of interaction with the robot. Participants appreciated the robot's engaging visual appearance and its ability to provide useful information. The overall experience is described as satisfying and instructive, marking a favorable impression.

"*Well, the first impression is quite nice. I like the look in his eyes. I mean, he's quite nice. In fact, it's a shame that there's this sort of screen, it dehumanises him a bit, I think, but there have to be screens for people who can't hear very well and it's too much computer, I think. The visual side of the computer isn't so much fun.*" (A025BN)

"*Very satisfied, good, very good.*"[...] "*Very interesting, very instructive because he's very knowledgeable*." (P090GM)

"*Well, the first impression is quite nice. I like his look. I mean, he's quite nice. In fact, it's a pity that there's this kind of screen, it dehumanizes him a bit, I think, but as there have to be screens for people who can't hear very well, it's too "computer" I think. The visual side of the computer isn't all that fun.*" [...] "*There's a contrast between ARI, which is very nice, and this sort of thing where you're in the computer, and it's not very clear*." (A025BN)

"*No but to a machine that looks like a human, but you feel it's a machine obviously*." [...] "*He looks rather nice.*" (P088LA)

"*I'm happy because I was so hoping for this.*" (P097DBA)

Acceptability of the robot - Wave 3 (Patients)

Patients in Wave 3 reported a mean total score of 22.27 (SD=5.26) **out of 30**. The median for this sample was 22 out of 30. The threshold for acceptability of the E-Scale is set at 25 out of 30, indicating a level of acceptability below the acceptable, and 5 patients reported a score above this threshold. The scores of participants in the first wave ranged from 11 to 30 out of 30.

26.67% (n=4) of patients reported a score below 20, 40% (n=6) between 20 and 25, and 33.33% (n=5) above 25. Figure 27 shows the average scores for each dimension of AES for the entire first wave sample (n=15 patients).

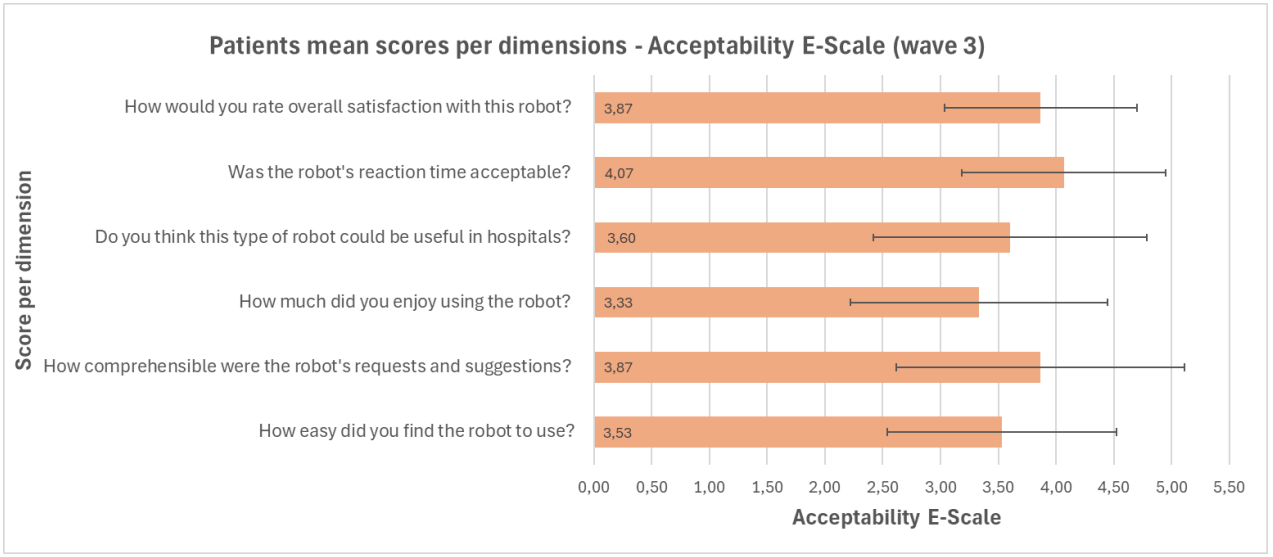


Figure 27. Acceptability E Scale scores per dimension in "Wave 3" - patients (n=15)

Patient scores on the various dimensions of the acceptability scale were fairly homogeneous, with higher scores for dimension 5 - appreciation of the system's response time (m=4.07; SD=0.88).

More average scores were reported for the other dimensions: dimension 1 - acceptability of the robot (m=3.53; SD=0.99), dimension 2 - robot comprehensibility (m=3.87; SD=1.25), dimension 3 - pleasure in using the system (m=3.33; SD=1.11), dimension 4 - usefulness of the robot in the hospital (m=3.60; SD=1.18) and dimension 6 - overall satisfaction with the system (m=3.87; SD=0.83).

Acceptability of the robot - Wave 3 (Accompanying persons)

Accompanying persons in Wave 3 reported a mean total score of 21.14 (SD=2.97) **out of 30**. The median for this sample was 22 out of 30. The threshold for acceptability of the E-Scale is set at 25 out of 30, indicating a level of acceptability below the acceptable, and 1 patient reported a score above this threshold. The scores of participants in the first wave ranged from 17 to 25 out of 30.

28.57% (n=2) of accompanying persons reported a score below 20, 57.14% (n=4) between 20 and 25, and 14.29% (n=1) above 25. Figure 28 shows the average scores for each dimension of AES for the entire first wave sample (n= accompanying persons).

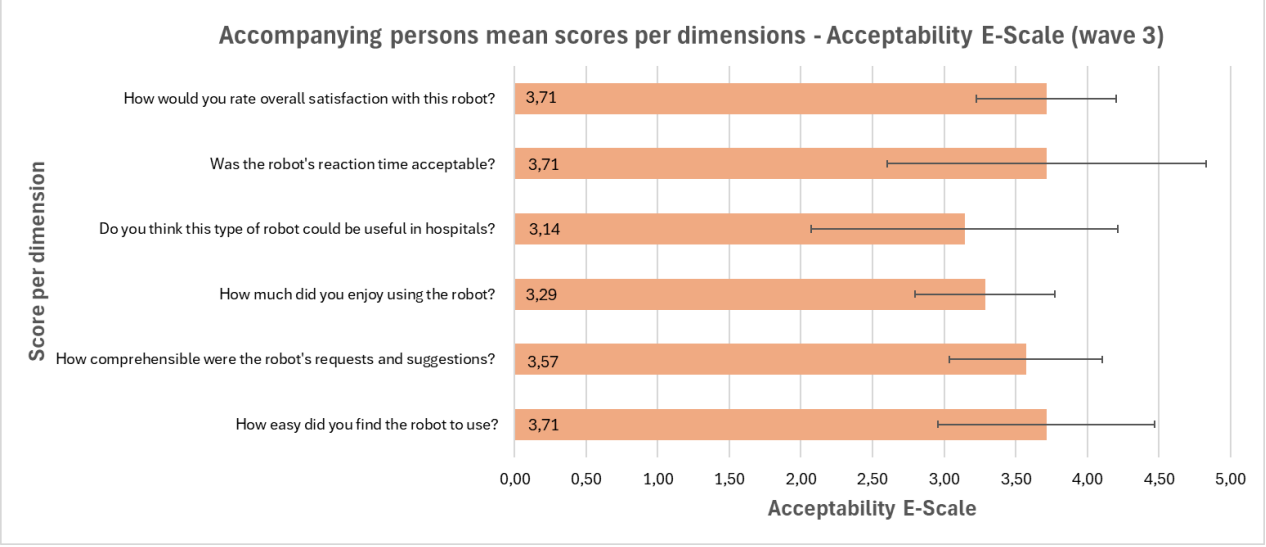


Figure 28. Acceptability E Scale scores per dimension in "Wave 3" - Accompanying persons (n=7)

Accompanying persons' scores on the various dimensions of the acceptability scale are fairly homogeneous, with higher scores equally for the following three dimensions: dimension 1 - acceptability of the robot (m=3.71; SD=0.76), dimension 5 - appreciation of the system's

response time (m=3.71; SD=1.11) and dimension 6 - overall satisfaction with the system (m=3.71; SD=0.49).

More average scores were reported for the other dimensions: dimension 2 - robot comprehensibility (m=3.57; SD=0.53), dimension 3 - pleasure in using the system (m=3.29; SD=0.49) and dimension 4 - usefulness of the robot in the hospital (m=3.14; SD=1.07).

Usability of the robot - Wave 3 (All participants)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 3, participants reported a mean score of 66.82 on the SUS scale (SD=17.56; med=66.25), which would be considered below average and considered as "Ok - marginal high" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

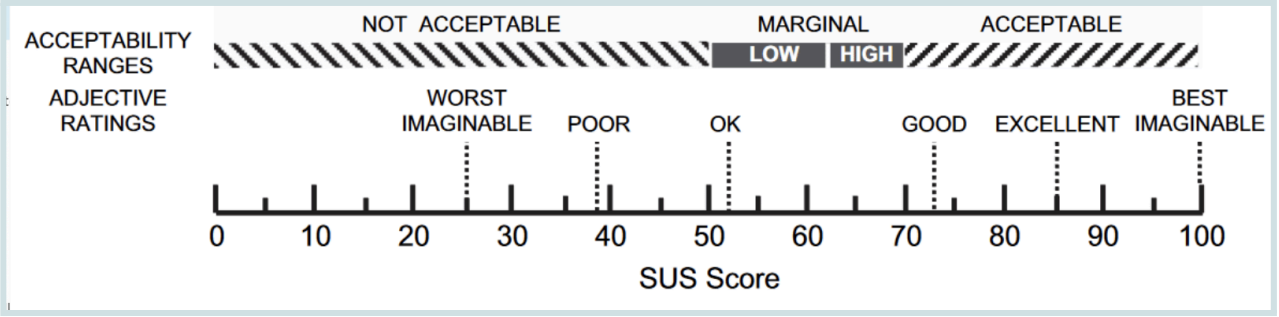


Figure 29. SUS scale acceptability rank

Figure 30 presents the scores given by the 22 participants on the SUS usability scale.

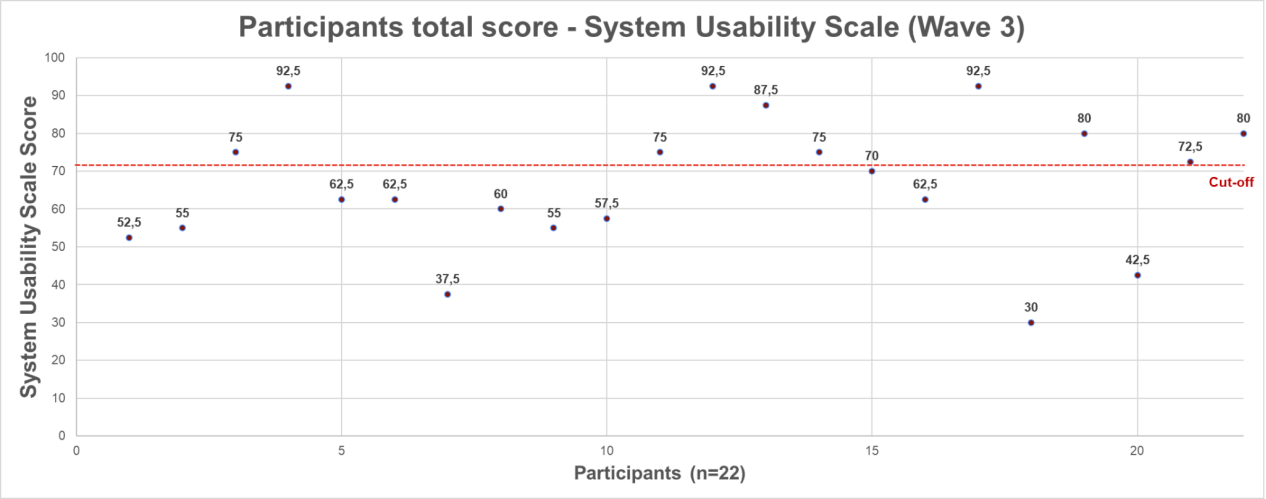


Figure 30. System Usability Scale Mean global scores in “Wave 3” – All participants (n=22)

The table 14 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 14.** System Usability Scale scores per dimension in "Wave 3" - All participants (n=22)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.36	1.14	0	4
2) I find the system unnecessarily complex.	2.73	0.94	1	4
3) I think the system is easy to use.	2.82	0.91	1	4
4) I think I would need the help of a technically skilled person to use this system.	2.77	1.34	0	4
5) I found the various functions in this system to be well integrated.	2.82	0.80	1	4
6) I think the system has too many inconsistencies.	2.82	1.01	1	4
7) I imagine that most people would learn to use this system very quickly.	2.95	0.90	1	4
8) I found the system very difficult to use.	2.41	1.26	0	4
9) I felt very confident using this system.	2.91	1.02	1	4
10) I think there is a lot to learn before one can effectively use this system.	2.14	1.52	0	4

Qualitative feedback given by the participants regarding the usability assessment is presented below.

I'd like to use this robot in hospital as often as possible (SUS): The participants reflected contrasting opinions on the frequent use of the robot in the hospital environment: while one user expressed a preference for human interaction, valuing the authenticity of these exchanges, another found the robot reassuring and simpler to use than other technological devices, appreciating its soothing visual aspect.

"I'd have to disagree. Yeah, because I like having a human being in front of me. Even if they are, we're not perfect. I'm not perfect. At least we have the real thing, I'm in the real thing." (P098BM)

"*Yes, because I find it soothing. I mean, there's something, er... It's easier than when I was in hospital and I had this screen where I had to press I don't know where. Anyway, that time I was a bit upset and... Yeah, I think it calms me down. Because in addition he has a really gentle look in his eyes, so I find that quite calming.*" (A025BN).

I find conversations with this robot unnecessarily complex (SUS): The reactions below reveal a mostly favorable perception of the simplicity of interactions with the robot, with several users stressing the clarity of exchanges, although one mentions a certain length in the responses, suggesting a need for optimization.

"*That's not true, it's very clear.*" (P090GM)

"*Is it complex? He says things quite clearly.*" (P097DBA)

"*No, it's not complex, I don't agree.*" (P096BCR)

"*It's not complex*." (P094BM)

"*Not too complex, but too long, I think.*" (P093BAM)

I think this robot is easy to use (SUS): These comments express a positive perception of the robot's ease of use, where users appreciate the simplicity of interaction, indicating that asking the robot a question is a straightforward and uncomplicated process.

"*Yes, we talk at the front, we've got nothing to do.*" (P090GM)

"*If it's just asking him a question, yes.*" (P095GM)

I think I'll need help to be able to interact with this robot (SUS): the following comments highlight the varied needs of users in terms of support when interacting with the robot, with some citing humor in the possible confusion of exchanges, while others feel a certain intimidation due to their lack of familiarity and habit with the robot.

"*It's possible, but in these cases, it will make me laugh.* [...] *Maybe if... if I'm confused in my question I don't know or that... you can be confused in a question, and then the person opposite, they... They don't understand.*" (A025BN)

[Why do you think you'd need help?] "*Because it intimidates me.* [...] *And I don't know him. I know ... I don't know how he works*." (P088LA)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

I thought the robot's various services were well thought out (SUS): Participants were positive about the design of the services offered by the robot, with users noting in particular the efficiency with which it answers questions, affirming that its functionalities are well thought-out.

> "*Yes, because they ask questions, so that's not bad.*." (P088LA)

> "*He answered my questions.* [...] *No, but it's true, he's not stupid.*" (P090GM)

> "*Well, that's good because he answers the questions directly.*" (P096BCR)

I think there are too many inconsistencies in this robot (SUS): These user feedbacks reveal mixed opinions about the consistency of interactions with the robot: some observe variability in the quality of responses, while others feel they don't have enough experience to judge the presence of inconsistencies, or are satisfied with the consistency of responses provided.

> "*It depends. Sometimes he responds well, sometimes he doesn't understand anything. So it's average*." (A027NH)

> "*Well, maybe I haven't practised enough to know if there are too many inconsistencies, but um* [...] *Well, no, there aren't too many inconsistencies.*" (A025BN)

> "*I don't know enough about it, but for the moment, I don't agree.*" (P096BCR)

I imagine that most people would be able to learn to use this robot very quickly (SUS): The feedback points to diverse user perspectives on how easy it would be for most people to learn to use this robot, highlighting both the simplicity of the initial interaction and the potential challenges associated with specific aspects of its operation, such as synchronizing responses.

> "*It's easy, I think. No, it's easy because you get to the front. He identifies you, so from the moment you go to the front, he's going to say 'Hello'.*" (A025BN)

> "*It's easy to use. On the other hand, the fact that it answers from the side and is out of sync, I think that can put a lot of people off.*" (A027NH)

> "*You don't learn because you have nothing to do.*" (P090GM)

> "*Accompanying persons, I agree. Patients who have a disorder, I'm not sure.*" (P093BAM)

I found it very difficult to talk and behave naturally with this robot (SUS): These responses describe users' varied experiences of the naturalness of their interactions with the robot, ranging from the ease of behaving naturally in a scripted context to recognition of the challenges posed by the novelty of communicating with a machine.

> "*Yes, because I wasn't in a real case. Otherwise I wouldn't have minded. Because in this case, I was obliged to write a script and so on, so...* [...] *So I had no problem being natural with him. Because I think he's got that human side.*" (A025BN)

> *"It's not very difficult, but not easy at first.*" (P094BM)

> "*Yes, of course, because we're not used to talking to a robot.*" (P093BAM).

I felt very confident using the robot (SUS): This testimonial reveals one user's hesitancy about using the robot, expressing a lack of confidence mainly due to his unfamiliarity with this new technology, compared here to learning a totally unfamiliar language.

> "*It's not a question of trust, it's just that for me it's a bit like Chinese. Do you know what I mean? Well, Chinese... As I don't understand the robot. I don't really understand this way of working because it's too new for me*." (P092SA)

I think there's a lot to learn to use this robot properly (SUS): Users' reactions to the question of the learning curve required for effective use of the robot vary: while one considers that talking to the robot requires no particular learning, another user highlights the challenge of adapting to communicating with a machine, underlining a certain learning curve due to this innovative technology.

> "*There's nothing to... We've got nothing to learn if that's what the question's about.*" [...] "*I have nothing to learn, you have to talk to him.*" (A027NH)

> "*Yes, of course, because we're not used to talking to a robot.*" (P093BAM)

Usability of the robot - Wave 3 (Patients)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 3, patients reported a mean score of 66.33 on the SUS scale (SD=20.68; med=62.5), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 15 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 15.** System Usability Scale scores per dimension in "Wave 3" - patients (n=15)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.20	1.26	0	4
2) I find the system unnecessarily complex.	2.87	0.99	1	4
3) I think the system is easy to use.	2.87	1.06	1	4
4) I think I would need the help of a technically skilled person to use this system.	2.47	1.46	0	4
5) I found the various functions in this system to be well integrated.	2.80	0.94	1	4
6) I think the system has too many inconsistencies.	2.87	1.19	1	4
7) I imagine that most people would learn to use this system very quickly.	2.93	0.80	2	4
8) I found the system very difficult to use.	2.60	1.35	0	4
9) I felt very confident using this system.	2.93	1.16	1	4
10) I think there is a lot to learn before one can effectively use this system.	2.00	1.73	0	4

Usability of the robot - Wave 3 (Accompanying persons)

With regard to the assessment of ease of use of the device, the results of the assessment made with the SUS scale showed that in wave 3, accompanying persons reported a mean score of 67.86 on the SUS scale (SD=8.95; med=70.0), which would be considered below average and considered as "OK - Marginal Low" according to the SUS rating scale (see below). As a reminder, a SUS score is considered unacceptable below 52, marginal between 52 and 72, and acceptable above 72.

The table 16 below presents a detailed analysis of the transformed scores for the ten questions in the System Usability Scale (SUS). The data includes the mean, standard deviation, minimum and maximum values for each question.

***Table* 16.** System Usability Scale scores per dimension in “Wave 3” - Accompanying persons (n=7)

Questions	Mean	Std Dev	Min	Max
1) I would like to use this system frequently.	2.71	0.76	2	4
2) I find the system unnecessarily complex.	2.43	0.79	1	3
3) I think the system is easy to use.	2.71	0.49	2	3

4) I think I would need the help of a technically skilled person to use this system.	3.43	0.79	2	4
5) I found the various functions in this system to be well integrated.	2.86	0.38	2	3
6) I think the system has too many inconsistencies.	2.71	0.49	2	3
7) I imagine that most people would learn to use this system very quickly.	3.00	1.15	1	4
8) I found the system very difficult to use.	2.00	1.00	1	3
9) I felt very confident using this system.	2.86	0.69	2	4
10) I think there is a lot to learn before one can effectively use this system.	2.43	0.98	1	3

Semi Structured interview on the ethical dimension - Wave 3

This section presents the main opinions given by the participants regarding the ethical issues addressed in the semi-structured interview (see annex 4). Some participants' verbatims were extracted from the interview transcripts and used to illustrate different views.

1/ Opinions regarding the development and use of robots with human-like appearance (humanoids)

"*For me, it's not very important whether they resemble humans or not. I don't identify with them; it's the answers they provide that matter to me.*" (A027NH)

"*I'm currently very skeptical because I don't have enough knowledge. The word robot for me is from my generation.*" (P092SA)

"[Do you approve of making robots that look like humans?] *Yes, because it has a friendly appearance.*" (P088LA)

"*Making robots that look like humans is fine as long as they don't try to replace real human interactions.*" (P095GM)

"*The appearance isn't much of an issue, but don't make them too human-like; keep them practical.*" (P094BM)

"*Why should they look like humans? I don't see the point unless it serves a specific functional purpose*." (P093BAM)

2/ Opinions regarding the social robots in the hospital, advantages and drawbacks

"*It's useful as long as it doesn't eliminate jobs. I believe you are often short of staff, right?*" (P090GM)

"*I don't know, I'm not sure if it brings an added value. I'm curious to see how it can evolve*." (A027NH)

"*It's supposed to be a tool to help people in a general way, so living with the times means using robots.*" (P092SA)

"*If it can relieve nurses for very mechanical tasks, then it's good.*" (P088LA)

"*This robot is used with voice commands only; you just need to ask questions out loud.*" (P091NCH)

"*They could be useful for simple directions or managing minor tasks to free up human staff.*" (P093BAM)

"*Useful for guidance and maybe handling some operational tasks in large hospitals.*" (P094BM)

3/ Opinions on the data collection and treatment made by robots

"It's like writing; if I don't handle it even if I give it a secret, it won't repeat it to everyone." (P090GM)

"*As long as it's about generic hospital function information, I have no problem with it keeping data.*" (A027NH)

"*Absolutely scared because I never pay anything over the internet, I don't trust it, and I don't manage my accounts so imagine if it was on my mobile.*" (P092SA)

"*It shouldn't have personal information, but it's okay for it to know general info like my doctor's name or appointment time.*" (P088LA)

"*Robots can be helpful for menial tasks but should not interfere with human care aspects.*" (P095GM)

"*Data should be handled with care; robots should only store what's necessary for their function and ensure privacy.*" (P095GM)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

"*Sensitive information shouldn't be handled by robots without stringent safeguards.*" (P094BM)

"*I'm not comfortable with robots recording personal conversations or data unless it's strictly controlled.*" (P093BAM)

4/ Concern about the mistakes (bugs, accidents) that social robots might make/cause

"*There surely are limits. It responded to everything perfectly this time, but sometimes it can go off track.*" (P090GM)

"*Currently, it makes mistakes, as we have observed, but these are mistakes that don't have serious consequences.*" (A027NH)

"*It's possible it could make mistakes, but that's not really my problem.*" (P092SA)

"*It could make a mistake just like anyone else, but I wouldn't hold it against the robot.*" (P088LA)

"[Do you think robots could make mistakes?] *Yes, it's possible.*" (A026NS)

"*Minor errors in tasks could be tolerable, but in medical settings, the stakes are too high.*" (P095GM)

"*Errors could be dangerous in my field of law; similarly, in medicine, you can't afford mistakes.*" (P094BM)

"*If a robot makes a mistake like sending someone to the wrong room, it's not a disaster but it's inconvenient.*" (P093BAM)

5/ Views regarding the possibility of having an emotional attachment to a robot

"*Maybe for someone who has no one to talk to and lets off steam, but otherwise no. Maybe when it is very useful, if it is linked to usefulness, it creates a link.*" (P090GM)

"*I don't think so. A robot is a machine. I don't think you can develop feelings for a robot.*" (A027NH)

"*It's not really my problem but... it's also possible for it to make mistakes, right? But you're not too worried about that?*" (P092SA)

"*For me no, but it would need to be something personal, maybe for kids or lonely elderly people.*" (P088LA)

"[Could you become attached to this robot? Like being happy to see it or sad when it's not there?] *That's difficult.*' (A026NS)

"*Maybe it could be different for someone else, someone who feels lonely and wants someone to talk to.*" (P095GM)

"*For others, maybe they can form some emotional connection if they're lonely.*" (P094BM)

"*Perhaps someone who is alone might develop something affectionate with a robot, but I don't think I would.*" (P093BAM)

6/ Opinions on the risk of the replacement of the human being by robots

"*So, it won't take away jobs? No, indeed with professionals for example there are times when there is a lot of queue and maybe it would be good to unload them a little.*" (P090GM)

"*A robot won't replace a caregiver. There's no empathy, no contact.*" (A027NH)

"*It can be very interesting for the majority of patients surely because it must still be a tool that helps people in a general way.*" (P092SA)

"*It can be useful for certain mechanical tasks, but I always prefer human contact.*" (P088LA)

"*Robots in factories, doing repetitive tasks—that makes sense, but replacing humans in personal interactions doesn't seem right to me.*" [...] "*They should only assist with tasks, not replace the jobs of healthcare professionals.*" (P095GM)

"*It's one thing in industry but in healthcare, personal human care is essential. Robots should assist, not replace." [...] "Robots should not replace human workers, but could handle menial tasks.*" (P094BM)

"*I'm against robots replacing humans entirely, especially in sensitive roles." [..] "If it's about replacing humans because there aren't enough or it's cheaper, then I'm against it.*" (P093BAM)

3.4 Inferential statistics on the acceptability and usability of the robot for Waves 1, 2, and 3

Following the three evaluations, inferential tests were applied to the Acceptability E-Scale and the System Usability Scale to examine potential significant differences between the 3 evaluation waves.

Acceptability of the robot - Comparison of the three experimental waves (All participants)

General analysis of acceptability

Figure 31 illustrates the distribution of total scores obtained via the E-Scale acceptability scale, collected over three separate experimental waves. The total scores are represented in the form of box plots, which highlight the median, quartiles and extreme values, providing an in-depth understanding of the variation in participants' responses.

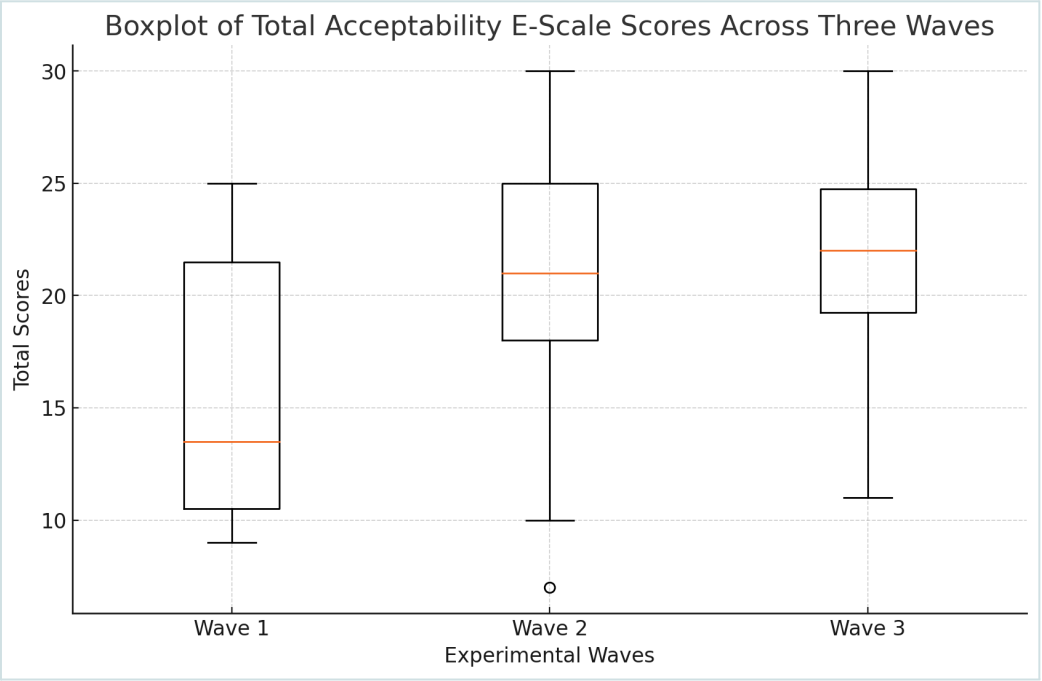


Figure 31. Acceptability E Scale Comparison Between Three Waves.

Box plot description

Wave 1 shows significant variability in responses, with a relatively low median. An extremely low score, visible as an isolated point, indicates significantly less favourable responses by some participants.

Wave 2 shows a marked improvement with a higher median, suggesting better overall acceptability. The distribution is more centred and shows less variability, indicating greater consistency in positive perceptions.

Finally, Wave 3 maintains a median similar to Wave 2, with a slight increase in variability.

The results presented show a positive trend in the acceptability of the ARI robot tested over the waves, with a significant reduction in the extreme low scores and an increase in the median.

The p-value of the analysis of variance of the comparison of the total acceptability scores between the three experimental waves is p=0.0011. This value indicates that the differences observed in the total scores between the waves are statistically significant.

To compare the medians of the total acceptability scores between the three experimental waves, we used the Kruskal-Wallis test, a non-parametric test suitable for independent samples that do not necessarily follow a normal distribution.

The Kruskal-Wallis test was used to assess whether the medians of the total scores differed significantly between the three experimental waves.

Table 17. Results of the Kruskal-Wallis Test for total Acceptability E-Scale Scores for the three experimental waves

Description	Statistique	P-value
Test de Kruskal-Wallis	10.095	0.0064

Analysis per question

Table 18, presented below, shows the means and standard deviations of responses for each question across the three waves.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Table 18. E-Scale Acceptability - Means and standard deviations of responses for each question across the three waves.

Question /waves	Wave 1		Wave 2		Wave 3		Mean Total scores
	Mean	STD	Mean	STD	Mean	STD	
Ease of Use	2.93	1.27	**3.46***	1.1	**3.59***	0.91	3.40
Clarity of Requests	3.5	1.22	**4.0***	1.05	3.77	1.07	3.82
Enjoyment of Interaction	**2.21***	1.19	**3.17***	1.22	**3.32***	0.95	3.03
Usefulness of answers	**2.29***	1.27	**3.05***	1.4	**3.45***	1.14	3.01
Reaction Time	**2.07***	1.44	**3.93***	1.06	**3.95***	0.95	3.60
Overall Satisfaction	**2.43***	1.28	**3.24***	1.2	**3.82***	0.73	3.26
Mean Total scores	**15,43**	5,81	**20.85**	5.25	**21.91**	4.61	

** Values in bold indicate a significant difference of 0.5 or more compared with the other waves.*

Figure 32 illustrates the distribution of scores for each question on the acceptability E-Scale, collected across three experimental waves. The data is represented in the form of box plots for each question, making it possible to clearly visualise the medians, quartiles and extreme values, and to understand the variations in participants' responses between the different waves.

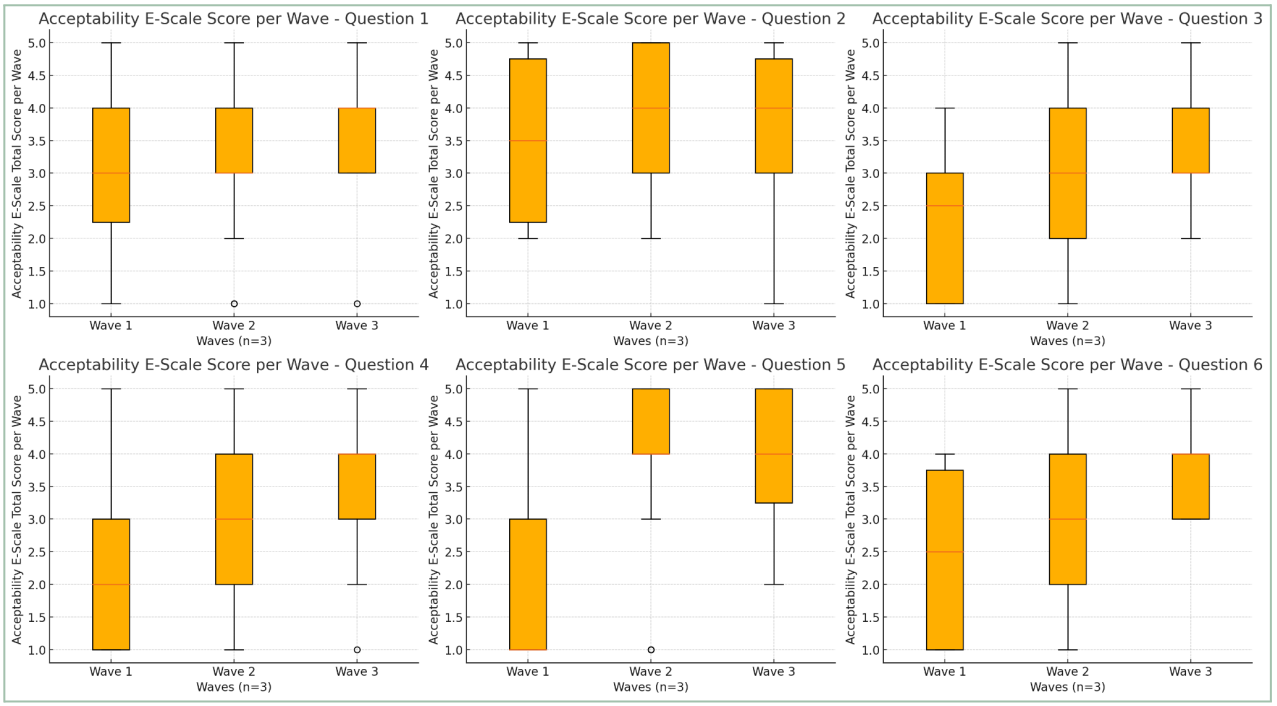


Figure 32. Acceptability E Scale Comparative analysis of the three experimental waves.

Each diagram shows the variations in scores for a specific question across the three experimental waves, with the median and IQR indicating the central tendency and variability of responses. Extreme values are represented by isolated points, highlighting atypical perceptions among participants.

System Usability Scale - Comparison of the three experimental waves (All participants)

General analysis of acceptability

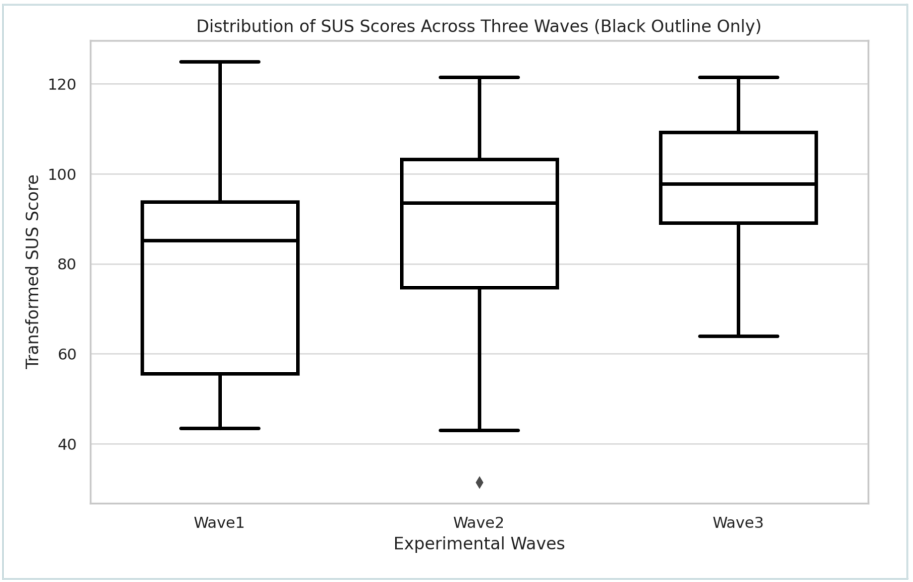


Figure 33. System Usability Scale Between Three Waves.

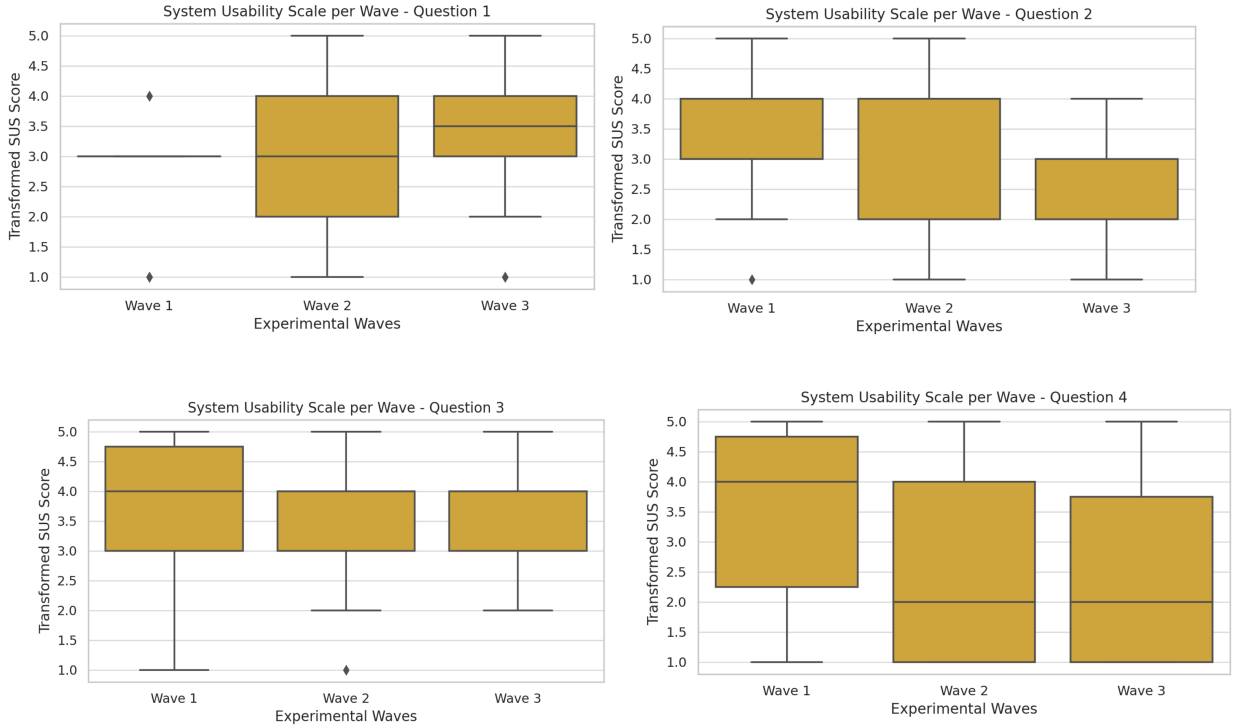
Analysis per question

Table 19, presented below, shows the means and standard deviations of responses for each question across the three waves.

Table 19. System Usability Scale - Means and standard deviations across the three waves.

Question /waves	Wave 1		Wave 2		Wave 3	
	Mean	STD	Mean	STD	Mean	STD
Mean Total scores	**47.86**	24.18	**57.50**	22.41	**66.82**	17.56

Figure 34 illustrates the distribution of scores for each question on the System Usability Scale, collected across three experimental waves. The data is represented in the form of box plots for each question, making it possible to clearly visualise the medians, quartiles and extreme values, and to understand the variations in participants' responses between the different waves.



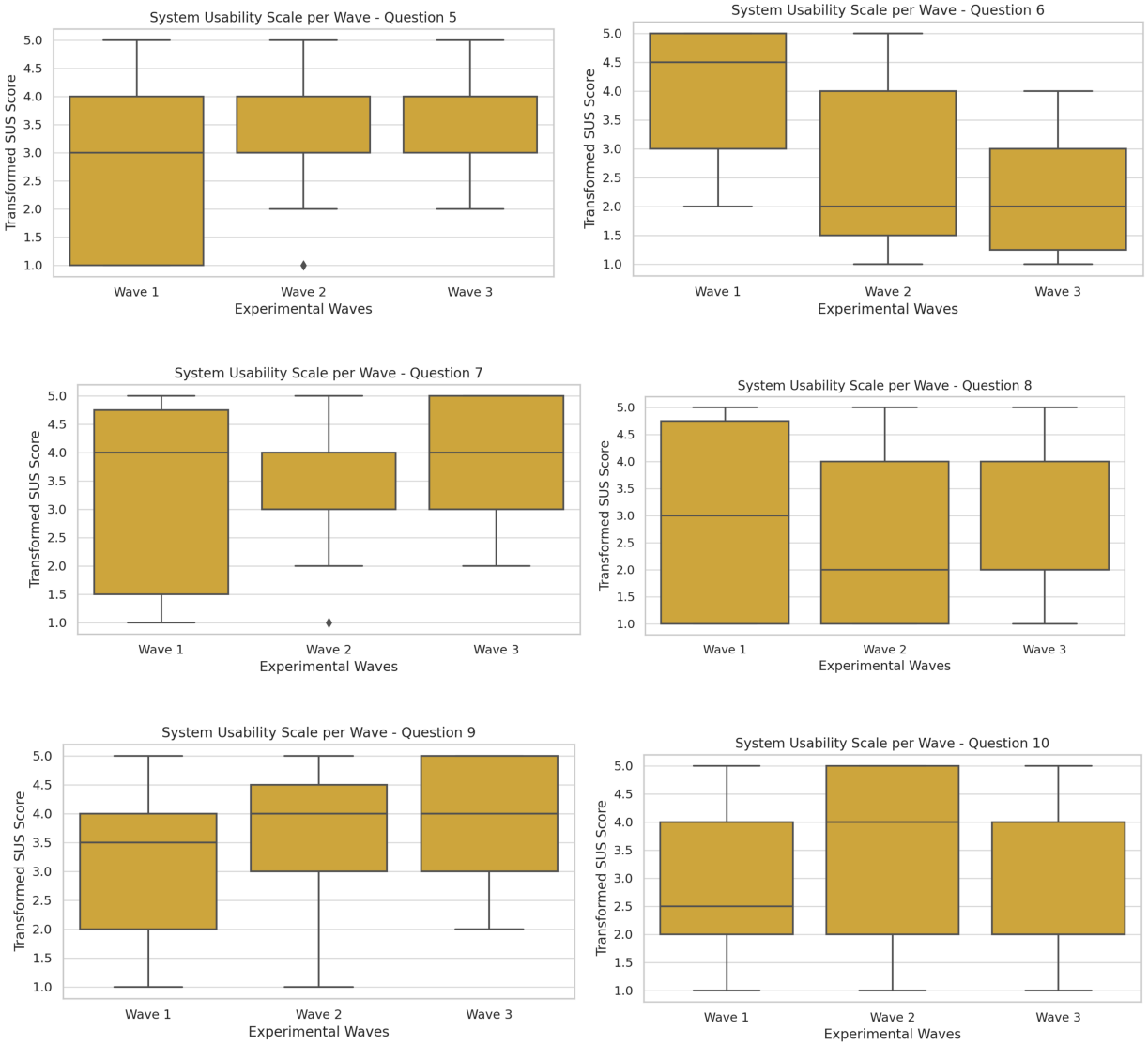


Figure 34. System Usability Scale Between Comparative analysis per question of the three Waves.

3.5 Specific description of each of the studies conducted in a real environment, healthcare professionals

Objectives

<u>The main objective of the professionals' assessment was:</u>

Conducting a dialogue with healthcare professionals at the daycare hospital on the organisational, ethical and social dimensions of integrating these new technologies.

Material

The material is described in section '3.3 Specific description of each of the studies carried out in a real environment, patients and companions - Material'.

Procedure

Two weeks before the date scheduled for the interview, the researcher contacted (by e-mail, telephone and face-to-face) the health professionals at the day hospital to present the study and arrange an appointment. Prior to this interview, the information note and consent forms were given to the healthcare professionals for reading and review. During the interview, the researcher discussed the study's objectives and protocols in detail, answering all the participants' questions and obtaining their informed consent to participate.

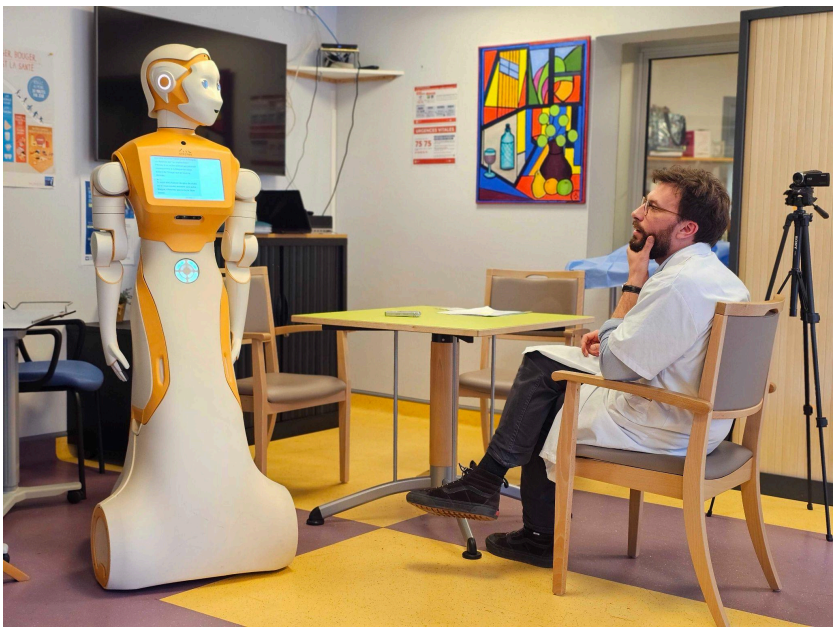


Figure 35. Examples of interaction between a healthcare professional and the robot.

Assessment

- Before interacting with the ARI robot, participants were asked to provide various items of information:
  - Their **socio-demographic data**, such as gender, age and socio-educational level.
  - Details of their **profession**, department and level of experience.

- Their affinity with technology was assessed using the **Affinity for Technological Interaction** (ATI) questionnaire. This questionnaire, developed according to the study by Franke, T., Attig, C., & Wessel, D. (2019), includes several items to measure their

propensity to interact with technology. Participants were encouraged to respond to each item and to provide explanations for their answers.

- In addition, their **knowledge of social robots** was assessed using a specific questionnaire, covering their familiarity with these technologies, their previous experience and their perception of their usefulness and potential in a hospital environment.
- After the interaction with the ARI robot, **semi-directive interviews** were conducted to discuss in depth the ethical issues related to the introduction of robots in the hospital environment. These interviews were structured according to the principles of the Health Technology Assessment Core Model®, version 3.0, provided by EuNetHTA 'European Network for Health Technology Assessment', in order to explore in detail the organisational, ethical and social dimensions of the introduction of health technologies.

3.5.1 Results for healthcare professionals (Day Care Hospital)

Period: April to may 2024

(A) Socio-demographic data - Professionals

A total of 15 volunteers took part in this evaluation.

Details of the recruitment procedure are given in section "*3.4 Specific description of each of the studies conducted in a real environment, healthcare professionals - Procedure*".

The socio-demographic data corresponding to the participants are presented in table 20.

Table 20. Socio-demographic data for professionals (n=15)

Variables	Modalities	Total
Count	-	15 (100%)
Gender	Male	5 (33.3%)
	Female	10 (66.7%)
Profile	Doctor	4 (26.7%)
	Care assistant	3 (20%)
	Secretary	2 (13.3%)
	Archivist	1 (6.7%)
	Medical and social assistance	1 (6.7%)
	Psychologist	2 (13.3%)

	Security agent	1 (6.7%)
	Hospital Director	1 (6.7%)
Age, years	*Min: 23*; *Max*: 65 *Mean:* 47.4 y/o *SD*: 11.68	
Socio-educational level	No diploma	3 (20%)
	Secondary school diploma	2 (13.3%)
	Vocational certificate	1 (6.7%)
	University diploma	2 (13.3%)
	Advanced university diploma	1 (6.7%)

A total of 12 of the 15 professionals interviewed work in the day care hospital at Broca Hospital. In addition to their work in the day care hospital, one professional said that he also worked in the long-term care unit and another in the mobile team.

The two professionals interviewed who did not work in the day care hospital were the security guard and the hospital receptionist.

The years of service of the professionals interviewed are shown in Figure 36.

Figure 36. Years of professional experience.

Results

(B) Affinity for Technological Interaction - Professionals

This section presents the results obtained in the evaluation of professionals' level of affinity with technology (ATI scale). Figure 37 displays the total scores given by the 15 professionals on the ATI.

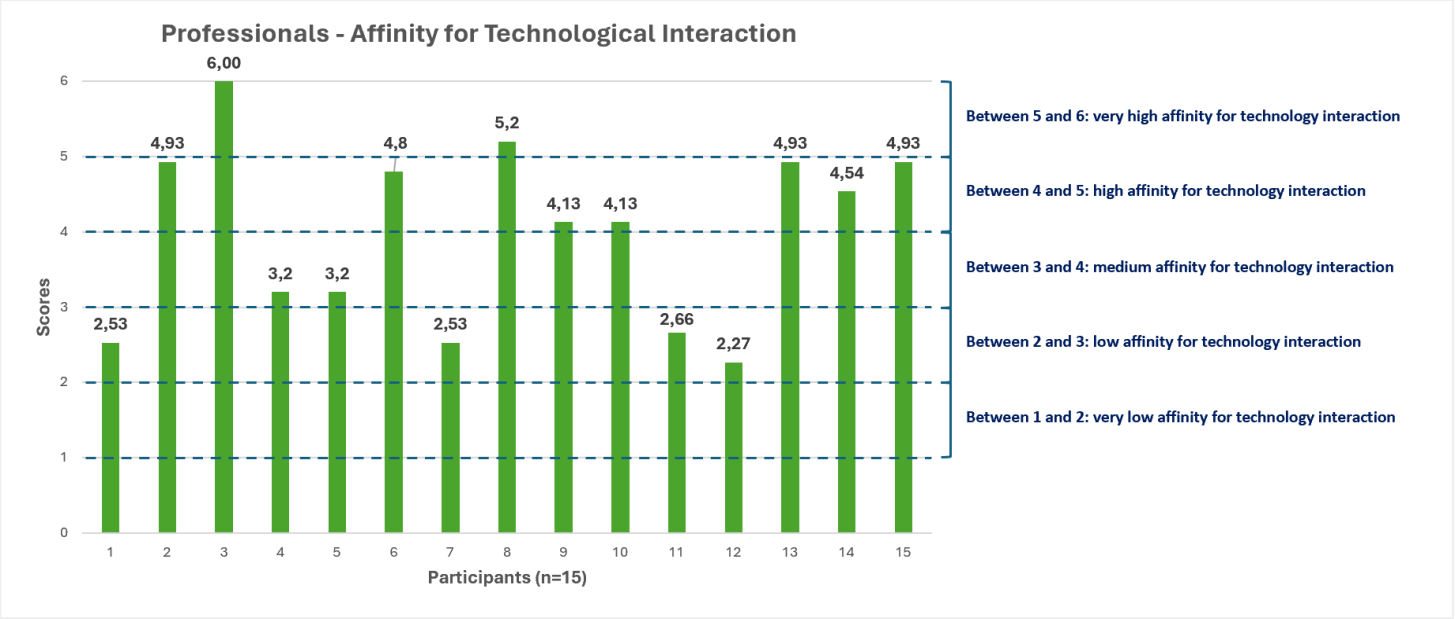


Figure 37. Professional scores on the ATI scale.

Professionals reported a mean total score of **4** (standard deviation = 1.17) **out of 6**. The median for this sample was 4.13 out of 6. For this scale, a really low affinity with the technology is between 1 and 2 out of 5, a low affinity between 2 and 3, a medium affinity between 3 and 4, a high affinity between 4 and 5 and a very high affinity with the technology between 5 and 6.

Professional scores ranged from 2.27 to 6 out of 6.

None of the participants said they had a very low affinity with the technology, 26.67% (n=4) have declared a low affinity, 13.33% (n=2) a medium affinity, 46.67% (n=7) a high affinity and 13.33% (n=2) a very high affinity with the technology.

(C) Knowledge of social robots - Professionals

Participants were asked about their knowledge of social and assistive robots. In response to this question, 3 professionals said they were not familiar with social and assistive robots. The other 11 professionals said they were familiar with social and assistive robots. Figure 38 shows the different robots known to healthcare professionals.

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Figure 38. Images of robots known to professionals

Of all the professionals involved, 5 use social robots a few times (e.g. Paro, Nao, Kompai and Rose) and 1 professional often uses social robots in his work (Paro, Nao, Cutii, Pepper). The professionals who use social robots a few times specified that they regularly take part in Broca Living Lab experiments.

In order to identify whether participants were used to talking to machines/voice assistants, we asked them whether they used voice assistants in their daily lives. In response to this question, 53.33% (n=8) said they never used them and 46.67% (n=7) said they used them a few times, such as Alexa, Siri or Google Assistant.

(D) Semi Structured interview - Professionals

Organisational dimension

Task Management and efficiency

The professionals mentioned that the integration of robots like ARI could significantly improve the management of tasks and the efficiency of hospital services. Professionals suggested various tasks, such as welcoming patients, accompanying them to different areas (lift, waiting room, consultation room), explaining health instructions, providing entertainment, providing information about patients' medical appointments, carrying out administrative tasks, etc. The examples below are taken from interviews with professionals:

> "*Robots can guide patients from the lift to the waiting room, allowing receptionists to concentrate on other essential tasks.*" [...] "*It's a complement, it will never replace direct contact, but it does help manage queues.*" [...] "*The robot can say... I don't know, it's like at the Post Office: 'You've come to drop off a parcel, you go to such and such an office'. It's a bit like that.*" [...] "*ARI was useful for explaining barrier procedures to patients, especially those who find it difficult to understand the instructions given by care staff.*" (PRO001MLS)

"*I think it's a good idea. Patients often ask us where the day care hospital is or when they have an appointment, they don't necessarily know where to go. So yes, I think it's a good idea to have a robot that can accompany them from the lift to the day care centre, for example, and things like that*." (PRO005JE)

"*It's good that patients always know that they can ask the robots for these kinds of questions, it's not bad that they have a reference. The fact that there's a terminal for all this so that they can ask, that's not bad.*' (PRO008DF)

"*The robot could be very useful for providing practical information and support for patients. However, it's important that users are well informed about how to use it to avoid misunderstandings.*" (PRO007LH)

"*I think it's great that the robots can explain the day care tests to patients, because often they're not very aware of what's going to happen.*" (PRO009CA)

"*I think robots could be very useful for administrative and logistical tasks, freeing up time for medical staff.*" (PRO010JS)

"*People were happy because they asked less often where the day care hospital was thanks to the robot's directions.*" (PRO011ASR)

"*For the day care hospital, the robot could be really useful for talking to older people and guiding them around the hospital.*" (PRO012MV)

"*If the robot works well and without bugs, it could be very useful for accompanying patients and explaining what they need to do.*" (PRO013GM)

Improving the hospital's image

Some professionals have pointed out that the adoption of robots could improve the hospital's image.

"*It can also be interesting from the point of view of recruitment and dynamisation, to show the innovative side of the hospital.*" [...] "*It's a hospital where we're able to innovate, evaluate it and fully integrate it into care practices.*" [...] "*The idea is that it always complements what healthcare professionals can do, that it's not there to replace them, on the contrary.*" (PRO002MP)

"*Having a robot in the hospital could show that we're at the cutting edge of technology and innovation.*" (PRO008DF)

"*It [the robot] could give a modern and innovative image of the hospital, which can be attractive to new patients and staff.*" (PRO007LH)

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"*Implementing robots could demonstrate the hospital's commitment to innovation and modernising care.*" (PRO010JS)

"*The robot could give a good image of modernity and technological progress for the hospital.*" (PRO012MV)

"*Seeing a new technology that accompanies them all the way could be seen as a good thing for the hospital.*" (PRO013GM)

Formations needs

Training needs were a recurring theme in the interviews.

"*It's important to provide regular training so that staff take full ownership of the use of robots.*" [...] "*For the robot, there should also be someone who can act as a reference and explain things a bit... there's theoretical training, but after that it's on the job that you see.*" (PRO001MLS)

"*We should have referents among the carers, someone who will be a bit more comfortable with the technology and who could help the others*." [...] "*I think that training should not be one-off, but ongoing so that staff stay up to date with the new features of the robots.*" (PRO002MP)

"*I think it's important to train the teams well so that they know exactly what the robot can do and how it can help them on a daily basis.*" (PRO004CR)

"*You have to be very clear about how to use the robots and train them so they know how to use them optimally.*" (PRO008DF)

"*Users need to be told how to talk to the robot, for example, to wait until it has finished talking before asking a new question to avoid confusion.*" (PRO007LH)

"*Clear, practical training is needed so that staff can use the robots effectively.*" (PRO009CA)

"*Regular training sessions and technology referents could greatly help the integration of robots.*" (PRO010JS)

"*Training should be provided to avoid apprehension and ensure smooth use of the robots.*" (PRO011ASR)

"*It would be important to have someone who knows the robot well to support its use at the beginning.*" (PRO012MV)

"*Professionals need to be comprehensively trained to understand all the functions and limitations of the robot.*" (PRO013GM)

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Ethical dimension

Quality of interactions

Professionals have expressed concerns about the quality of interactions between robots and patients.

> "*Certain tasks, particularly those involving bodily care, should not be delegated to robots for ethical reasons.*" [...] "*It is crucial that the use of robots does not lead to a dehumanisation of care.*" [..] "*Robots must be seen as complementary aids and not as replacements for essential human interaction.*" (PRO002MP)

> '*It could be stressful for some patients to approach a robot, especially those with specific pathologies such as memory disorders.*" (PRO008DF)

> "*It's important that the robot doesn't replace essential human interaction, but is there to complement it.*" (PRO007LH)

> "*Misunderstanding during interactions can be frustrating for patients, especially if they are not used to talking to machines.*" (PRO009CA)

> "*Care must be taken to ensure that robots do not create a barrier between the patient and the healthcare staff.*" (PRO010JS)

> "*Robots should be used to complement human interaction, not replace it.*" (PRO011ASR)

> "*Robots can provide support, but they should not replace the human warmth of carers.*" (PRO012MV)

> "*We need to carefully assess whether patients can assimilate and understand why there is a robot, especially those who are already disorientated*." (PRO013GM)

Confidentiality and Data Security

Confidentiality and data security were sensitive issues.

> "*Robots must be programmed to ensure that sensitive information is not compromised.*" [...] "*I'm against recording, anything that keeps data in memory is a problem.*" [...] "*For example, the robot would have to record for how long? If, for example, it has a memory of an hour or half a day, could that be acceptable?*" (PRO001MLS)

> "*What worries me is whether robots can store patients' personal information. That raises a privacy issue*." (PRO002MP)

"*The issue of data confidentiality is crucial. Patients' personal information must not be recorded or compromised.*" (PRO007LH)

"*Data collection and storage must be strictly controlled to avoid any breach of patient privacy.*" (PRO009CA)

"*It is essential that strict protocols are put in place for the management of data collected by robots.*" (PRO010JS)

"*Data protection is a priority, we must ensure that robots do not compromise patient confidentiality.*" (PRO011ASR)

"*Data confidentiality is essential, and care must be taken to ensure that robots do not store sensitive information.*" (PRO012MV)

"*We need to be sure that the system doesn't bug and that the data is well protected to prevent any leaks.*" (PRO013GM)

Acceptance and Ethical Use

The ethical use of robots is essential to ensure their acceptance.

"*The integration of robots must respect the fundamental ethical values of the health sector.*" [...] "*Robots must be seen as complementary aids and not as replacements for essential human interaction.*" [...] "*In very general information, yes. In the idea of how a consultation takes place, it doesn't do the consultation instead. It explains how things are going to work, and takes the drama out of it.*" (PRO002MP)

"*The day it doesn't work, we'll put ARI in a corner at reception and say "today ARI can't work, it will work tomorrow.*" (PRO004CR)

"*We have to make sure that robots don't give the impression of replacing healthcare professionals, but rather assisting them*." (PRO009CA)

"*Robots must be used ethically, respecting patients' needs and rights.*" (PRO010JS)

"*Robots must be seen as complementary tools and not as substitutes for carers.*" (PRO011ASR)

"*The robot must be presented as an aid and not as a replacement for carers.*" (PRO012MV)

"*Patients must understand that the robot is there to help them and not to replace medical staff.*" (PRO013GM)

Social dimension

Social Acceptability

The social acceptability of robots in hospitals depends on how patients and professionals perceive them.

> "*Although the organisational benefits are recognised, technophobia and patient reluctance need to be overcome.*" [...] "*I think if we welcome ARI, we need others to ensure patients and staff fully understand their usefulness.*" (PRO001MLS)

> "*It's crucial that awareness and training campaigns are put in place to promote acceptance of robots.*" [...] "*It is important that robots are integrated gradually so that patients and staff get used to their presence.*" (PRO002MP)

> "*Some patients it could be an interesting novelty, but for others it could be a source of stress.*" (PRO008DF)

> "*Patients need to be well informed about the role of robots to avoid misunderstandings and fears.*" (PRO007LH)

> "*It's important to explain the role of robots to patients properly so they don't feel replaced or watched over*." (PRO009CA)

> "*Information and awareness campaigns are needed to get patients and staff to accept robots*." (PRO010JS)

> "*The benefits of robots need to be well communicated so that patients and staff accept them*."(PRO011ASR)

> "*Clearly explaining the purpose and benefits of robots to patients and staff is crucial to their acceptance*." (PRO012MV)

> "*We need to test the acceptance of robots with patients before deploying them on a massive scale*." (PRO013GM)

Impact on Patients

Patients' reactions to robots can vary.

> "*Some patients may be uncomfortable with non-human interaction, especially those who are unfamiliar with technology.*" [...] "*For patients, it is a novelty that can arouse interest or indifference.*" (PRO001MLS)

"*There are patients who are very keen on new technologies, but others who are completely opposed.*" (PRO002MP)

"*On the negative side perhaps I think that people they have... I don't know if anyone's ever told you this but maybe older people are a bit scared of robots like that of new technology.*" (PRO004CR)

"*Patients with memory problems or psychiatric pathologies might not benefit from the use of robots and would prefer human contact.*" (PRO008DF)

"*For some patients, the robot may seem intimidating, especially if they are not used to this type of technology.*" (PRO007LH)

"*Some patients may feel intimidated or uncomfortable with robots, especially if they are not familiar with the technology.*" (PRO009CA)

"*might react differently to robots, some might find them helpful, others intimidating*." (PRO010JS)

"*may be reluctant at first, but with time and information they may get used to them and see the benefits.*" (PRO011ASR)

"*Patients might be happy to see a robot, especially if it helps them and brings them some joy.*" (PRO012MV)

"*Disorientated patients or those needing a human presence might find it difficult to accept robots.*" (PRO013GM)

Adapting physical spaces

Physical spaces need to be adapted to accommodate robots.

"*Physical adjustments need to be made in hospitals to make it easier for robots to move around without disrupting day-to-day operations.' [...] 'I find that the current premises are not adapted to accommodate a robot like ARI, some spaces need to be rethought.*" (PRO001MLS)

"*The premises have to be ready to receive robots, there have to be spaces wide enough for them to move around.' [...] 'The robot needs to be able to move around easily in the corridors without getting in the way of patients and staff.*" (PRO002MP)

"*Patients need fixed landmarks, so the robot must have a fixed location where they can find it easily*." (PRO008DF)

"*It's crucial to think about the ergonomics and accessibility of spaces so that the robot can move around without hindrance.*" (PRO007LH)

"*The premises must be laid out in such a way as to allow the robots to move around smoothly without hindering patients and staff.*" (PRO009CA)

"*Spaces must be adapted so that robots can move around easily and efficiently.*" (PRO010JS)

"*It is important to provide suitable spaces so that robots can move around smoothly.*" (PRO011ASR)

"*The robot must be adapted to the layout of the premises so as not to impede the passage and organisation of services.*" (PRO012MV)

"*We need to rethink certain areas so that the robot can move around unhindered and carry out its tasks efficiently.*" (PRO013GM)

Interventions and Activities

Professionals have also pointed out that robots can also be used to entertain and inform patients:

"*The robot could do activities like riddles or trivia in the waiting rooms.' [...] 'In the day care waiting room, some patients are against robots, but others might enjoy ARI entertaining them.*" (PRO001MLS)

"*In the waiting room, ARI could keep patients occupied by telling jokes or asking little questions to keep them entertained.*" (PRO002MP)

"*On the positive side, he could relieve congestion at reception by directing patients and offering activities to help them wait.*" (PRO004CR)

"*The robot can help make the queue smoother and reassure patients by giving them information about their waiting time.*" (PRO008DF)

"*The robot could provide practical information and entertainment to make waiting less stressful for patients*." (PRO007LH)

"*The robot could entertain patients by telling jokes or asking questions while they wait.*" (PRO009CA)

"*The robot can keep patients occupied in the waiting room with interactive activities, which can reduce their anxiety.*" (PRO010JS)

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"*The robot could offer small games or information to keep patients occupied while they wait.*" (PRO011ASR)

"*The robot could lead activities for patients in the waiting room, making the wait more enjoyable.*" (PRO012MV)

"*Patients can interact with the robot during their wait, which can make the experience more pleasant and create a bond*." (PRO013GM)

4. General discussion and conclusions of the final assessments

This section of the report is organized into two primary sections. The first section addresses the evolution of quantitative assessments conducted across the three waves of final tests of the SPRING project: *Wave 1, Wave 2, and Wave 3*. This part provides a detailed analysis of the progression in user experiences, perceptions, and interactions with the socially assistive robot developed during the project.

The second section focuses on the qualitative analysis conducted throughout the project's phases. This analysis covers crucial aspects such as usability, acceptability, and ethical issues associated with the deployment of the robot. By examining both quantitative and qualitative data, this discussion aims to provide a comprehensive understanding of the SPRING project's outcomes and their broader implications for the integration of robotic technology in healthcare environments.

Analysis of the evolution of quantitative assessments across the SPRING project final tests waves

General improvements and impact on acceptability scores (AES)

Over the three experimental waves, the ARI robot has benefited from numerous improvements targeting its stability, perception and interaction with users. The updates were guided by an incremental approach, aimed at refining the robot's perception and interaction capabilities, which is plainly reflected in the E-Scale and SUS scores.

This section provides a discussion on the improvements observed in the acceptability results, delving into a detailed analysis and exploring the implications of the Acceptability E-Scale data across the three experimental waves of the final experimentations.

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Between the first and third waves, the ease of use of the robot improved significantly, with scores rising from 2.93/5 (wave 1) to 3.59/5 (wave 3). Initially, during Wave 1, participants expressed diverse opinions: some experienced difficulties because the robot could not provide direct answers to questions and repeatedly mentioned food, while others appreciated the convenience of verbal interaction. In response to these mixed reviews, enhancements were made to the user interface, leading to a more intuitive design that reduced the learning curve for users. By the third wave, the integration of a large language model (LLM) and further improvements to the robot's functionality made interactions easier for participants. These improvements in ease of use were evident in the higher acceptability scores recorded.

The clarity of the robot's responses saw a significant improvement, with scores increasing from 3.50/5 (wave 1) to 3.77/5 (wave 3). Initially, during Wave 1, responses were sometimes off-topic or misunderstood, highlighting the need for better language processing capabilities. By the third wave, focused enhancements in these areas led to clearer and more relevant suggestions and requests from the robot. This improvement in language processing was crucial in facilitating smoother and more comprehensible interactions, making the robot's communication more effective and user-friendly.

Enjoyment of using the robot increased significantly from 2.21/5 (wave 1) to 3.32/5 (wave 3). Although early feedback in Wave 1 indicated a preference for human interaction over robotic assistance, improvements in dialogues and user interface customization made interactions increasingly pleasant and engaging. By Wave 3, participants noted that the robot's interactions were more natural and enriched.

The robot's perceived usefulness in hospital environments increased significantly (from 2.29/5 in wave 1 to 3.45/5 in wave 3). Initial participant feedback indicated confusion and a lack of clear guidance from the robot, which was not always seen as helpful (Wave 1). This improved perception is probably due to more effective interactions and the integration of conversational prompts specifically adapted to the needs of hospital environments, facilitating better integration of the robot in these settings.

Robot reaction time improved significantly, rising from 2.07 in Wave 1 to 3.95 in Wave 3. Initially, participants expressed frustration with the robot's slowness and repetitive questioning in Wave 1. However, ongoing adjustments to the robot's non-verbal behavior and sensory perception led to a more responsive performance by Wave 3. Participants in the later stages praised the improvements, highlighting the timeliness and accuracy of the robot’s responses, which significantly enhanced the overall user experience.

Robot reaction time increased significantly, from 2.07/5 (wave 1) to 3.95/5 (wave 3), illustrating a marked improvement in the robot's ability to respond in a timely and accurate manner. This

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enhancement can be attributed to optimizations of the robot's reactions and improved sensory perception in the second wave, as well as ongoing adjustments to non-verbal behavior and planning management in the third wave.

Overall satisfaction rose steadily, starting at 2.43/5 in the first wave and reaching 3.82/5 in the third. The integration of a LLM and adjustments in head movements and gaze analysis contributed to this increase. Although concerns persisted about the robot's effectiveness in environments with vulnerable populations, improvements in stability and responsiveness led to heightened overall satisfaction by the third wave.

These improvements reflect the progressive and targeted upgrades made to the ARI robot with each wave. The focus on enhancing the robot's perceptive, reactive, and interactive capabilities has significantly increased its acceptability among participants. Ongoing refinements based on participant feedback suggest that efforts to improve the robot's technology and interface are not only justified but also successful. These enhancements pave the way for further innovations and improvements in robotic interaction, demonstrating the positive impact of continuous development and user-centered design.

General improvements and impact on usability scores (SUS)

In this section, we discuss the significant evolution of the usability of ARI, evaluated through three waves of experimentation using the System Usability Scale (SUS). It is essential to stress that ARI is not simply a prototype but an advanced experimental platform designed to test and improve user interactions in a hospital context. This distinction is crucial because the evaluation criteria and expectations in terms of SUS scores for finished products do not apply in the same way to an experimental platform, which is constantly evolving and adapting.

Over the course of the trial phases, ARI demonstrated a marked improvement in its usability, as shown by the SUS scores, which rose from 47.86/100 in the first wave to 66.82/100 in the third wave. This progression indicates not only an improvement in the integration and functionality of the on-board technologies, but also a better adaptation to the needs and expectations of end-users.

Details of evaluation waves

Initial scores were relatively low, with an average score of 1.71 for the desire to use the robot as frequently as possible and 2.64 for ease of use. These results reflect an initial exposure where participants were less confident, as shown by the mean score of 2.00 for confidence in using the system. The perceived complexity of the system was also high, reflected by an average score of 1.79.

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There was a considerable improvement in the second wave, with an average score of 2.05 for the desire to use this robot as often as possible and 2.63 for ease of use. User confidence also increased, reaching an average score of 2.51. In addition, participants felt that more people would be able to use the robot more easily. These results show increased adaptation and a positive response to the adjustments made after the first evaluation.

The third wave showed the highest scores, with an average score of 2.36 for willingness to use the ARI robot as frequently as possible in hospital and 2.82 for ease of use, indicating better integration of the system by participants. User confidence also reached a high score of 2.91. This wave illustrates strong acceptance and improved understanding of the robot by users.
The integration of an LLM and the addition of robot head movements played a key role in this improvement. By making exchanges more transparent, understandable and 'live', this has overcome some of the initial obstacles to using the robots effectively.

In order to continue on this path of improvement, it is recommended to continue making adjustments based on ongoing feedback from users to further refine the interface and interactions. It is also essential to set up robot presentation sessions for users to get them used to interacting with a machine. It is also important to carry out regular evaluations to monitor changes in usability and adapt ARI to the changing needs of the hospital environment.

(B) Qualitative analysis of usability, acceptability, and ethical issues in the final test waves of the SPRING project

This section discusses four main themes derived from the qualitative analysis of data collected during the final assessments of the SPRING project in a day care hospital setting. These themes provide insights into the usability, acceptability, and ethical issues related to the deployment of socially assistive robots in healthcare environments.

Theme 1. Ease of use and complexity of interactions with the robot

The findings from the final usability assessments conducted within the SPRING project, revealed a range of opinions among participants (patients, accompanying persons and professionals) regarding the robot's ease of use and the complexity of interactions. While some participants appreciated the robot's voice responses numerous challenges were noted. Participants frequently reported that the robot struggled to answer questions accurately, leading to complicated and sometimes frustrating interactions. This complexity was highlighted by the

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perception that the robot's responses were often off-target or insufficiently detailed. Despite these challenges, many participants found the overall solution to be acceptable and usable.

It is essential to consider that the SPRING project involved the development of an experimental platform rather than a final commercial product. The project's iterative and progressive approach to improvement and module integration explains why some functions were not fully stabilized. This context is crucial for interpreting the findings presented in this report, as the robot's performance and usability were expected to improve throughout the project's duration.

In the context of innovative technologies, it is common for usability, performance, and acceptance to evolve over time. Studies have shown that user acceptance of new technologies is often a process, improving as technical stability and functionality are enhanced (Venkatesh, Morris, Davis, & Davis, 2003). The **Technology Acceptance Model** (TAM) highlights that perceived ease of use and perceived usefulness are critical factors influencing user acceptance (Davis, 1989). As the technology becomes more stable and reliable, users are more likely to find it useful and easier to integrate into their routines, leading to higher acceptance levels (Venkatesh & Bala, 2008).

Moreover, usability issues commonly arise in the early stages of technology adoption and can be mitigated through iterative design and continuous user feedback (Nielsen, 1993). This aligns with the findings of the SPRING project, where iterative improvements and continued integration of modules aimed to address observed issues and enhance the robot's overall functionality and user experience.

To enhance the integration and acceptance of robotic technology in healthcare settings, the following practice recommendations are proposed based on the SPRING project results:

Implement iterative design and integrate user feedback continuously for optimal improvement

- Continuously incorporate user feedback into the development process to address usability issues and enhance the robot's functionality.
- Regular iterations based on user experiences can significantly improve the acceptance and performance of the technology.

Provide Comprehensive Training and Continuous Support for Users of Robotic Technology

- Provide thorough training programs for both staff and patients to familiarize them with the robot's capabilities and limitations. Ensuring users understand how to interact effectively with the robot can reduce frustration and improve overall satisfaction.

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Theme 2. Balancing human care and robotic assistance: ethical considerations in hospital robot integration

In discussing the desired robot usage in the hospital, participants in the SPRING project raised a significant concern involving the risk of dehumanization within healthcare environments—an issue that has been extensively debated in the literature.

Many participants preferred human interaction over robotic assistance, reflecting sentiments similar to those found in studies like Turkle's (2011), which argues that while technology can offer substantial aid, it should not replace the human elements of care that are crucial for patient satisfaction and emotional support. This preference aligns with research suggesting that frequent hospital visitors, who are more familiar with the environment, may find robotic services less practical or even redundant (Bemelmans et al., 2012).

Conversely, the potential benefits of robotic assistance, particularly for first-time or infrequent hospital visitors, were acknowledged. Robots can provide consistent information and guidance, potentially enhancing the visitor experience by reducing confusion and stress associated with navigating a new environment (Moerman et al., 2016). However, the risk of extensive robotic integration leading to staff reductions was highlighted, echoing the findings of Sharkey and Sharkey (2012), who caution that over-reliance on robots could result in a loss of personal contact that is vital for comprehensive patient care.

As noted by Sparrow and Sparrow (2006), the substitution of robots for human staff in roles that involve significant emotional or personal interaction could lead to a "depersonalized" healthcare environment where patients may feel they are receiving impersonal or mechanized care. This could be particularly detrimental in settings that cater to vulnerable populations, such as the elderly or those with cognitive impairments, who might benefit more from human interaction than robotic efficiency.

While robotic technology has the potential to enhance hospital operations and patient care, it is crucial to approach its integration thoughtfully, ensuring that it supplements rather than replaces the human elements of healthcare. Balancing technological advances with the preservation of essential human interactions is vital to maintaining a compassionate and effective healthcare environment.

Accordingly, some practice recommendations for a balanced integration of robotic technology that respects patient and staff autonomy are presented hereafter.

Ensure patient and staff autonomy in technology use by allowing them the choice of whether to utilize robotic assistance.

- Providing alternative human support options alongside robotic services, ensuring that individuals who prefer personal interaction can opt out of using the robot.

- Implementing a feedback mechanism where users can express their preferences and experiences with robotic technology, which can guide future adjustments and improvements.

Promote user education and training programs about the robots used in the hospital to enhance their acceptance and effectiveness.

- Developing thorough training programs for both patients and staff, explaining how to interact with the robot and highlighting its advantages.
- Conducting informational sessions and demonstrations to familiarize users with the robot's functions, thereby reducing anxiety or confusion associated with its use.

Implement an inclusive and iterative decision-making process to ensure that the integration of robotic technology is balanced and meets the needs of the hospital community.

- Establishing a committee comprising healthcare professionals, hospital administration, patient representatives, and technical experts to oversee the integration of robotic technology. By facilitating these meetings, stakeholders can voice their concerns and suggestions, ensuring transparency and collective ownership of the integration process.
- Regularly reviewing and updating the decision-making process based on feedback and technological advancements, ensuring continuous improvement and alignment with users' needs.

Theme 3. Leveraging technology to enhance attractiveness for healthcare institutions and future professionals

Participants consistently highlighted the potential for the robot to enhance the hospital's image as a center of innovation and technological advancement. They emphasized that implementing such technology could attract new patients and staff by showcasing the hospital's commitment to modernizing care and adopting cutting-edge solutions.

Participants noted that the presence of the robot could serve as a dynamic recruitment tool, reflecting the hospital's innovative spirit and ability to integrate advanced technologies into everyday care practices. Importantly, there was a consensus that the robot should complement, rather than replace, the functions of healthcare professionals, thereby enhancing the overall care experience without diminishing the essential human element. These insights underscore the

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perceived value of the robot in portraying the hospital as a forward-thinking institution committed to continuous improvement and innovation.

According to the Technology Acceptance Model (TAM), technology acceptance is significantly influenced by the perceived usefulness and ease of use of the technology (Davis, 1989). Moreover, the perceived status that comes with technology use, such as being seen as innovative and modern, can further drive acceptance (Venkatesh & Bala, 2008). In this context, participants' views that the robot could enhance the hospital's image align with the notion that perceived status and the associated prestige can positively impact technology adoption.

Furthermore, the current situation in many healthcare institutions is characterized by significant recruitment challenges and a shortage of professionals (World Health Organization, 2020). Innovative technologies, such as socially assistive robots, can serve as a lever to shift the perspective of potential employees, making the institution more attractive by highlighting its commitment to innovation and modernizing care practices. This aligns with findings in the literature that suggest showcasing innovation can be an effective strategy for improving recruitment in the healthcare sector (Aiken et al., 2012).

A crucial point raised by the professionals who took part in the SPRING study was the necessity for robots to complement, rather than replace, human healthcare professionals. This perspective aligns with existing academic literature that emphasizes the importance of maintaining the human element in care delivery. Studies have shown that while technology can enhance efficiency and support certain tasks, the irreplaceable value of human interaction in healthcare lies in empathy, emotional support, and nuanced decision-making (Coeckelbergh, 2013; Sharkey & Sharkey, 2012).

For instance, Coeckelbergh (2013) argues that the integration of robots in healthcare should be approached with caution to ensure that the fundamental human aspects of care are preserved. The ethical considerations of robot care highlight the risk of dehumanization if robots are used to replace human caregivers entirely. Instead, robots should be utilized to assist with routine tasks, allowing healthcare professionals to focus on more complex and emotionally demanding aspects of patient care.

Sharkey and Sharkey (2012) also discuss the potential ethical issues associated with the widespread use of robots in elderly care. They emphasize that robots should not be seen as a replacement for human caregivers but as tools that can support and enhance the quality of care provided. By handling routine and physically demanding tasks, robots can free up healthcare professionals to spend more time on direct patient care, thereby improving the overall care experience.

Based on the SPRING results analysis, some practice recommendations are proposed hereafter to enhance the integration and acceptance of socially assistive robots in healthcare institutions.

Leverage technology to enhance hospital image and recruitment

- Integrate and showcase innovative technologies, such as socially assistive robots, to enhance the hospital's image and attract new patients and staff by demonstrating a commitment to innovation.

Ensure socially assistive robots are used to complement human care and enhance patient experience in healthcare institutions

- Ensure that socially assistive robots complement, rather than replace, healthcare professionals, maintaining the essential human element of care while leveraging technology to support and streamline healthcare practices.

Theme 4: Ethical and privacy considerations in the deployment of socially assistive robots

Some ethical and privacy considerations emerged from the assessments and were considered crucial for the successful deployment of socially assistive robots in healthcare environments, as reflected in the perspectives of patients, accompanying persons, and professionals.

Data protection and privacy: For participants, the use of the robot's camera raised significant privacy concerns, particularly in contexts where patients and staff may not consent to being filmed. Ensuring compliance with EU General Data Protection Regulation (GDPR) was considered essential, and the usage needed to be clearly communicated to users. This aligns with the current use of hospital cameras, which are declared to the CNIL (Commission Nationale Informatique & Libertés) the French Data Protection Agency and used systematically for the security of property and individuals without filming patient rooms or workplaces directly. However, the key issue is how the data is processed afterward. If the video footage is used exclusively for navigation without further processing, this could be acceptable, provided that this can be guaranteed. This highlights the importance of transparent data management practices to maintain trust and ensure compliance with legal standards.

Recording and Consent: Healthcare professionals in our study strongly suggested that patients and accompanyning persons must be informed that the robot may record interactions to improve the services it provides and this must be done with informed consent. This consent should be clearly communicated in advance. If obtaining consent for every interaction is not feasible, which is often the case in hospital settings, robust data protection measures must be in place. This

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includes ensuring that the data is stored on secured servers and is not processed beyond the robot's operational needs.

These findings align with trends found in academic literature, which emphasize the importance of privacy and informed consent in the deployment of robotic technologies. According to Borenstein and Pearson (2010), the ethical deployment of robots in care settings necessitates careful consideration of privacy concerns and the establishment of clear guidelines to protect user data. Additionally, Vandemeulebroucke et al., (2018) highlight that maintaining transparency about data usage and ensuring robust consent mechanisms are critical for the ethical integration of robots in healthcare.

According to this analysis, we propose the following practice recommendations to guide the future implementation of socially assistive robots in healthcare settings, ensuring respect for users' privacy.

Implement transparent data management practices that ensure that all data collected by socially assistive robots is handled in compliance with GDPR or relevant regulations.

- Clearly communicate to users how their data will be used and ensure that video footage and other sensitive information are processed exclusively for the robot's navigation or other specified operational needs without further processing.

Establish robust informed consent mechanisms for potential users of robots in healthcare settings

- Develop and implement procedures to obtain informed consent from patients and staff regarding the recording of interactions with the robot. This should include clear, upfront communication about the purposes of data collection and use.
- In situations where obtaining consent for every interaction is impractical, ensure that comprehensive data protection measures are in place, including the use of secured servers and limitations on data processing to essential operational needs.

Conclusion

The final assessments of the SPRING project in relevant environments, such as the day care hospital, highlighted several key insights into the integration of socially assistive robots in healthcare settings. While there were notable challenges related to the ease of use and conversational complexity of the robot, participants—including patients, accompanying persons, and healthcare professionals—recognized the technology's potential. The iterative development process within the SPRING project aimed to address these issues and enhance the robot's overall

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functionality and user experience. This suggests that the robot's usability and acceptability will continue to improve, leading to a more refined and effective solution in the future. As technical stability increases, it is expected that user acceptance will also grow, reflecting a natural progression in the adoption of innovative technologies.

Integrating socially assistive robots in healthcare institutions requires careful consideration of technical, ethical, practical, and financial aspects. Ensuring that robots complement rather than replace human professionals, addressing privacy concerns, and developing a sustainable deployment strategy are critical for successful implementation. By maintaining a focus on these key areas, healthcare institutions can effectively leverage the benefits of robotic technology, ultimately enhancing patient care and operational efficiency.

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6. Annexes

Annex 1. Information letter for participants (patients + accompanying persons), original French version

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ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

Titre complet de la recherche :
« Un robot socialement pertinent pour l'accompagnement des soins gérontologiques »

Acronyme : SPRING

Cette recherche est promue par l'Assistance Publique - Hôpitaux de Paris
Représentée par le Directeur de la
Direction de la Recherche Clinique et de l'Innovation (DRCI)
1 avenue Claude Vellefaux
75010 Paris

NOTE D'INFORMATION – participants avec collecte des données – version 1.1 du 14/04/2021

Madame, Monsieur,

Le Professeur Anne-Sophie RIGAUD exerçant à l'hôpital Broca vous propose de participer à une recherche psychosociale concernant votre état de santé.

Il est important de lire attentivement cette note avant de prendre votre décision ; n'hésitez pas à lui demander des explications.

1) Quel est le but de cette recherche ?

Le projet SPRING vise à développer un robot social d'accueil (voir figure 1), capable de discuter avec plusieurs personnes.

Nous cherchons également les meilleures manières d'utiliser ce robot à l'hôpital

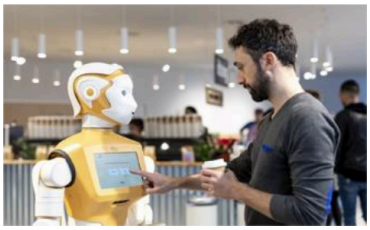

Figure 1. Illustrations du robot utilisé dans l'étude SPRING

Pour répondre à la question posée dans la recherche, il est prévu d'inclure 250 personnes (patients, accompagnateurs des patients et professionnels de l'hôpital) à l'hôpital Broca (Paris).

2) En quoi consiste la recherche ?

Le robot sera présent à l'hôpital de jour. Un chercheur vous accompagnera dans la découverte du robot. Nous vous proposerons de découvrir l'une ou l'autre de ces fonctionnalités :

- accueillir les visiteurs,
- prévenir les interactions sociales présentant un risque sanitaire,
- assister les visiteurs et les professionnels pour la préparation des consultations,
- orienter les visiteurs dans l'enceinte de l'hôpital de jour et plus largement dans l'hôpital,

- proposer des divertissements et des contenus d'information lors des périodes d'attente entre deux consultations.

Cette interaction avec le robot durera environ une demi-heure en fonction du service testé et des disponibilités relatives à vos rendez-vous médicaux. Nous vous inviterons ensuite à en discuter avec un psychologue chercheur afin de lui formuler votre avis général sur le robot ainsi que sur la pertinence de la fonctionnalité testée. Le psychologue chercheur vous proposera à cette occasion de compléter avec son aide, deux très courts questionnaires et de répondre à quelques questions guidées. Cet entretien durera environ 50 minutes.

Le robot enregistre votre voix et votre image pour vous répondre et se comporter avec le plus de naturel possible.

Ces données font l'objet d'analyse par les ingénieurs de l'INRIA et ses partenaires pour améliorer le robot. Les chercheurs de Broca vous demanderont ensuite de nous donner votre avis sur ce robot.

3) Quel est le calendrier de la recherche ?

La durée prévisionnelle de la recherche est de 17 mois et votre participation se déroulera pendant vos temps d'attente entre vos rendez-vous à l'hôpital de jour. Elle n'entravera pas le déroulement de vos rendez-vous à l'hôpital de jour.

Après la lecture de cette note d'information, si vous êtes d'accord de participer à la recherche, son déroulement sera le suivant :

1. Arrivée à l'hôpital de jour,
2. Déroulement de vos rendez-vous habituels à l'hôpital de jour,
3. Découverte du robot (environ ½ d'heure) sous la supervision d'un chercheur de l'AP-HP,
4. Dans le courant de votre journée et en fonction de vos rendez-vous, un entretien avec un psychologue-chercheur vous sera proposé pour connaître votre avis sur le robot (environ 50 minutes). Durant cet entretien, il vous sera demandé de répondre à deux questionnaires et à un court entretien de 6 questions nous permettant de préciser votre appréciation des robots sociaux en général et en particulier à l'hôpital. Les professionnels se verront proposer un entretien supplémentaire pour déterminer l'impact de la présence du robot dans leur travail.

   SI VOUS ETES PATIENT(E) : vous serez reçu(e) en entretien à la fin de leur journée d'hospitalisation ou durant la journée si un créneau horaire le permet.
   SI VOUS ETES ACCOMPAGNANT(E) : Vous serez reçu(e) pendant les consultations des patients.
   SI VOUS ETES PROFESSIONNEL(LE) : Vous serez reçu(e) en entretien en fonction de vos contraintes professionnelles indépendamment de la présence du robot à l'hôpital de jour.
5. Suite et fin de vos rendez-vous à l'hôpital de jour.

Il n'y a aucun risque à participer à cette recherche.

Elle est encadrée par la législation européenne et française et a reçu les agréments des institutions référentes.

4) Quels sont les bénéfices liés à votre participation ?

Votre participation à ce protocole de recherche n'est pas rémunérée. Vous ne tirerez aucun bénéfice personnel de votre participation à cette étude, mais, grâce à votre participation, nous pourrons améliorer les fonctionnalités du robot : orienter, informer et divertir le public.

5) Si vous participez, comment vont être traitées les données recueillies pour la recherche ?

Dans le cadre de la recherche à laquelle il vous est proposé de participer, un traitement de vos données personnelles va être mis en œuvre par l'AP-HP, promoteur de la recherche, et responsable du traitement, pour permettre d'en analyser les résultats.

Ce traitement est nécessaire à la réalisation de la recherche qui répond à la mission d'intérêt public dont est investie l'AP-HP en tant qu'établissement public de santé hospitalo-universitaire.

A cette fin, les données médicales vous concernant et les données relatives à vos habitudes de vie, seront transmises au Promoteur (AP-HP) et l'INRIA le coordonnateur de l'étude SPRING.

Ces données seront identifiées par un numéro d'enregistrement. Ces données pourront également, dans des conditions assurant leur confidentialité, être transmises aux autorités de santé françaises ou étrangères (à l'union européenne : Italie, Tchéquie, Espagne et hors de l'union européenne : en Ecosse et en Israël, ces 2 pays hors Union européenne sont qualifiés comme pays adéquats par le site de la CNIL : https://www.cnil.fr/fr/la-protection-des-donnees-dans-le-monde).

Les données médicales vous concernant pouvant documenter un dossier auprès des autorités compétentes, pourront être transmises à un industriel afin qu'un plus grand nombre de patients puissent bénéficier des résultats de la recherche. Cette transmission sera faite dans les conditions assurant leur confidentialité.

Vos données pourront être utilisées pour des recherches ultérieures ou des analyses complémentaires à la présente recherche en collaboration avec des partenaires privés ou publics, en France ou à l'étranger (dans l'union européenne : Italie, Tchéquie, Espagne et hors de l'union européenne : en Ecosse et en Israël), dans des conditions assurant leur confidentialité et le même niveau de protection que la législation européenne.

Vous pouvez vous opposer à tout moment à l'utilisation de vos données auprès du médecin investigateur de l'étude, Pr RIGAUD Anne-Sophie.

Vos données ne seront conservées que pour une durée strictement nécessaire et proportionnée à la finalité de la recherche. Elles seront conservées dans les systèmes d'information du responsable de traitement jusqu'à deux ans après la dernière publication des résultats de la recherche.

Vos données seront ensuite archivées selon la réglementation en vigueur.

Le fichier informatique utilisé pour cette recherche est mis en œuvre conformément à la règlementation française (loi « Informatique et Libertés » modifiée) et européenne (Règlement Général sur la Protection des Données - RGPD). Vous disposez d'un droit d'accès, de rectification, de limitation et d'opposition au traitement des données couvertes par le secret professionnel utilisées dans le cadre de cette recherche. Ces droits s'exercent auprès du médecin en charge de la recherche qui seul connaît votre identité (identifié en première page du présent document).

Si vous décidez d'arrêter de participer à la recherche, les données recueillies précédemment à cet arrêt seront utilisées conformément à la réglementation, et exclusivement pour les objectifs de cette recherche. En effet, leur effacement serait susceptible de compromettre la validité des résultats de la recherche. Dans ce cas, vos données ne seront absolument pas utilisées ultérieurement ou pour une autre recherche.

En cas de difficultés dans l'exercice de vos droits, vous pouvez saisir le Délégué à la Protection des données de l'AP-HP à l'adresse suivante : protection.donnees.dsi@aphp.fr, qui pourra notamment vous expliquer les voies de recours dont vous disposez auprès de la CNIL. Vous pouvez également exercer votre droit à réclamation directement auprès de la CNIL (pour plus d'informations à ce sujet, rendez-vous sur le site www.cnil.fr).

6) Comment cette recherche est-elle encadrée ?

L'AP-HP a pris toutes les mesures pour mener cette recherche conformément aux dispositions du Code de la santé applicables aux recherches impliquant la personne humaine.

L'AP-HP a obtenu pour cette recherche l'avis favorable du Comité de Protection des Personnes Ouest II le 03/05/2021.

7) Quels sont vos droits ?

Votre participation à cette recherche est entièrement libre et volontaire. Si vous ne souhaitez pas participer à la recherche il suffit de le dire au médecin.

Vous êtes libre de refuser ou d'interrompre votre participation à cette étude à tout moment sans encourir aucune responsabilité ni aucun préjudice de ce fait et sans avoir à vous justifier.

Vous pourrez, tout au long de la recherche et à l'issue, demander des explications sur le déroulement de la recherche au médecin investigateur de la recherche.

Vous pouvez vous retirer à tout moment de la recherche sans justification.

Si vous faites partie du groupe de patients participant à cette recherche, votre retrait n'aura aucune conséquence sur la suite de votre traitement ni la qualité des soins qui vous seront fournis et sans conséquence sur la relation avec votre médecin. À l'issu de votre retrait, vous pourrez être suivi par la même équipe médicale.

Dans ce cas, les données collectées jusqu'à votre retrait seront utilisées pour l'analyse des résultats de la recherche.

À l'issue de la recherche et après analyse des données relatives à cette recherche, vous pourrez être informé(e) des résultats globaux par l'intermédiaire du médecin investigateur de la recherche.

Vous pouvez également accéder directement ou par l'intermédiaire d'un médecin de votre choix à l'ensemble des vos données médicales en application des dispositions de l'article L 1111 – 7 du Code de la Santé Publique.

Cadre réservé au service

Nom/Prénom/Identifiant du participant :

Opposition exprimée : □ **Oui** □ **Non**

Date de délivrance de l'information :

Signature du responsable de la consultation / du service :

Document réalisé en 2 exemplaires. Un exemplaire doit être conservé 15 ans par l'investigateur, le deuxième doit être remis à la personne participant à la recherche.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Annex 2. System Usability Scale SUS (patients + accompanying persons), English version

1. I would like to **use** this robot (talk to, interact with, perform an action) in the hospital as frequently as possible.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

2. I find **conversations** with this robot unnecessarily complex.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

3. I think this robot is **easy to use** (talk, behave, act).

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

4. I think **I will need help** to be able to interact (exchange, talk) with this robot

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

5. I found that the different services (functions) of this robot have been **well thought out (designed)**.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

6. I think there are too many **inconsistencies** in this robot.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

7. I imagine that most people would **be able to learn how to use** this robot very quickly.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

8. I found it very **difficult to speak and behave naturally** with this robot.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

9. I felt very **confident** using the robot.

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

10. I think there is a lot to **learn to be able to use** this robot well (talk, behave, act).

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Annex 3. Acceptability E-Scale AES (patients + accompanying persons), English version

N°	Items	Scores
1	How easy did you find this robot to use (talk, behave, act)?	
1 – Very difficult **2 –** Difficult **3 –** Moderately easy **4 –** Easy **5 –** Very easy		
2	How understandable were the robot's requests and suggestions?	
1 – Very difficult to understand **2 –** Difficult to understand **3 –** Moderately understandable **4 –** Understandable **5 –** Totally understandable		
3	How much did you enjoy using (talking, behaving, acting) this robot?	
1 – Not at all **2 –** Slightly **3 –** Moderately **4 –** Very **5 –** Enormously		
4	How useful has this robot been to you in (a. greeting you / b. fostering health-safe social interactions / c. helping you prepare for consultations / d. orienting and guiding you / e. entertaining you)?	
1 – Totally useless **2 –** Useless **3 –** Moderately useful **4 –** Useful **5 –** Very useful		
5	Was the time spent by this robot to (a. greet you / b. foster social interactions without health risks / c. help you prepare for consultations / d. orient and guide you / e. entertain you) acceptable?	
1 – Not at all **2 –** Slightly **3 –** Moderately **4 –** Very **5 –** Extremely		
6	How would you rate your overall satisfaction with this robot?	
1 – Very unsatisfied **2 –** Unsatisfied **3 –** Neutral **4 –** Satisfied **5 –** Very satisfied		
	TOTAL	...../30

Annex 4. Observation booklet (inclusion criteria, socio-demographic data, AES scale, SUS scale, semi-structured interview) (patients + accompanying persons) - original French version

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

UN ROBOT SOCIALEMENT PERTINENT POUR L'ACCOMPAGNEMENT DES SOINS GERONTOLOGIQUES
« **SOCIALLY PERTINENT ROBOT IN GERONTOLOGICAL HEALTHCARE**»
SPRING

Cahier d'observation
Version 1.1 du 13/09/2022

Code participant ....
N° d'inclusion Initiales Nom & Prénom

Catégorie du participant : □ Patient □ Accompagnateur □ Professionnel

Investigateur coordonateur
Pr Anne-Sophie Rigaud
Chef de pôle gérontologie
Hôpital Broca, Hôpitaux Universitaires Paris Centre,
Assistance Publique – Hôpitaux de Paris (AP-HP)
54-56 rue Pascal, 75013 Paris
Tél : 01 44 08 35 03
Courriel : anne-sophie.rigaud@aphp.fr

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This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

DATE D'INCLUSION

Date : ……/……/……

Données sociodémographiques :

Remplir avec le participant uniquement les informations **en gras.**

- Date de signature du formulaire de non-opposition : ……/……/……
- Code participant : (N° d'inclusion - Initiales Nom & Prénom) : …… - ……
- **Date de naissance : ……/……/……**
- Âge : …… ans
- Genre : □ homme □ femme

Données médico-sociales :

- **MMSE** = ……/30, réalisé le ……/……/…… Non pertinent

- **Niveau socio-éducatif :**

□ **NC 1** : illettré

□ **NC 2** : sait lire, écrire et compter

□ **NC 3** : niveau de fin d'études primaires

□ **NC 4** ; niveau de brevet d'études de premier cycle (au total, à partir du cours préparatoire, 9 années de scolarisation), ou pour les métiers manuels niveau CAP sans spécialisation

□ **NC 5** : niveau classe de terminale (fin du deuxième cycle secondaire, 11 ou 12 années de scolarisation), ou pour les métiers manuels, niveau ouvrier ou artisan avec responsabilité technique ou de gestion)

□ **NC 6** : niveau baccalauréat ou métiers manuels hautement qualifiés avec cursus prolongés

□ **NC** 7 : niveau de diplôme universitaire

Cas d'usage expérimenté à l'HDJ avec le participant

□ a. accueil
□ b. favoriser des interactions sociales sans risques sanitaires
□ c. aide à la préparation des consultations
□ d. orienter et guidage
□ e. divertissement

CRITÈRES D'ÉLIGIBILITÉ PATIENTS

Critères d'inclusion

	OUI	NON
1. Personne âgée de plus de 60 ans		
2. Acceptant de participer à l'étude et ayant signé lui-même ou son représentant légal un formulaire de non-opposition		
3. Maitrise suffisante de la langue française		
4. Personne ne présentant pas un syndrome démentiel au stade sévère MMSE<10 (diagnostiqué par un gériatre ou un neurologue)		
5. Personne ne présentant pas de symptômes d'altération de la réalité (diagnostiqué par un gériatre ou un neurologue)		

Si au moins une réponse NON, le patient ne peut être inclus

Critère de non inclusion

	OUI	NON
1. Ayant exprimé, ou le cas échéant, leur famille, leur tuteur ou leur représentant légal leur opposition à la participation à l'étude		

Si réponse OUI, le patient ne peut pas être inclus

CRITÈRES D'ÉLIGIBILITÉ ACCOMPAGNATEURS

Critères d'inclusion

	OUI	NON
6. Personne majeure		
7. Ayant exprimé sa non-opposition à participer pleinement à l'étude		
8. Maitrise suffisante de la langue française		

Si au moins une réponse NON, le patient ne peut être inclus

Critère de non inclusion

	OUI	NON
2. Ayant exprimé son opposition à la participation à l'étude		

Si réponse OUI, le patient ne peut pas être inclus

CRITÈRES D'ÉLIGIBILITÉ PROFESSIONNELS

Critères d'inclusion

	OUI	NON
1. Ayant exprimé sa non-opposition à participer pleinement à l'étude		

Si au moins une réponse NON, le patient ne peut être inclus

Critère de non inclusion

	OUI	NON
3. Ayant exprimé son opposition à participer pleinement à l'étude		

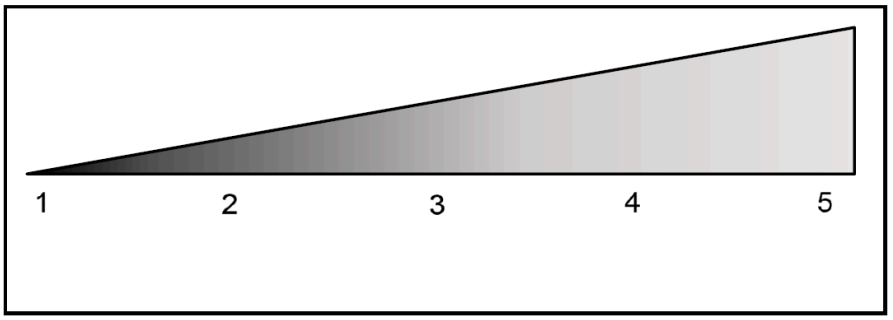
Si réponse OUI, le patient ne peut pas être inclus

Consignes générales de passation.

Cette enquête vise à nous aider à comprendre l'influence de la présence du robot sur votre visite à l'hôpital de jour.

Elle comprend trois séries de questions (quatre pour les professionnels) et dure environ 25 minutes (35 minutes pour les professionnels).

Pour répondre aux deux premières séries de questions, je vais vous demander de vous positionner à l'aide de ce support visuel entre 1 et 5.



« 1 » étant le score le plus négatif et « 5 » le score le plus positif.
Vous pouvez bien sûr utiliser toutes les valeurs 1, 2, 3, 4, 5 pour répondre aux questions.

Par exemple, je peux vous demander : « A quel point avez-vous trouvé ce robot facile d'utilisation ? » de 1 Très difficile à 5 très facile.

Pour la troisième série de question (et la quatrième, pour les professionnels), je vous demanderai votre avis sur les robots en général.

Acceptez-vous que j'enregistre notre conversation pour ne pas perdre d'information.

Est-ce que vous avez des questions ?

- **Acceptability E-Scale (AES)** (pour tous les participants)**.** Cette échelle permet d'évaluer l'acceptabilité de nouvelles technologies de manière quantitative et s'articule autour de deux dimensions : la facilité d'utilisation perçue et la satisfaction.

La consigne est la suivante :
Pour commencer, je vais vous poser six questions pour préciser ce que vous avez pensé de ce robot. Je vais vous demander de répondre le plus spontanément possible en vous positionnant sur une échelle de 1 à 5. Vous devez donc choisir un chiffre entre 1 à 5 pour me dire ce que vous pensez du robot, "1" étant le score le plus négatif et "5" le score le plus positif.

N°	Items	Scores
1	À quel point avez-vous trouvé ce robot facile d'utilisation (parler, se comporter, agir) ?	
1 – Très difficile **2 –**Difficile **3 –** Moyennement facile **4 –** Facile **5 –** Très facile		
2	À quel point les demandes et les suggestions du robot étaient-elles compréhensibles ?	
1 – Très difficile à comprendre **2 –** Difficile **3 –** Moyennement facile **4 –** Facile **5 –** Très facile à comprendre		
3	À quel point avez-vous apprécié l'utilisation (parler, se comporter, agir) de ce robot ?	
1 – Pas du tout **2 –** Un peu **3 –** Moyennement **4 –** Beaucoup **5 –** Énormément		
4	À quel point ce robot vous a-t-il été utile pour (a. vous accueillir / b. favoriser des interactions sociales sans risques sanitaires / c. vous aidez à préparer les consultations / d. vous orienter et vous guider / e. vous divertir) ?	a. b. c.
1 – Complètement inutile **2 –**inutile **3 –** moyennement utile **4 –** utile **5 –** très utile		d. e.
5	Le temps consacré par ce robot à (a. vous accueillir / b. favoriser des interactions sociales sans risques sanitaires / c. vous aidez à préparer les consultations / d. vous orienter et vous guider / e. vous divertir) était-il acceptable ?	a. b. c.
1 – Pas du tout **2 –** un peu **3 –** moyen **4 –** Beaucoup **5 –** Énormément		d. e.
6	Comment évaluez-vous votre satisfaction générale de ce robot ?	
1 – Très insatisfait **2 –** Un peu insatisfait **3 –** Moyennement satisfait **4 –** Satisfait **5 –** Très satisfait		
TOTAL		..... / 30

Page **5** sur **13**

- **System Usability Scale (SUS)** (pour tous les participants) : Cette échelle permet d'évaluer de manière dont les participants jugent les performances du robot dans le contexte de l'interaction.

La consigne est la suivante :
Maintenant, je vais vous lire dix affirmations pour préciser comment vous jugez les performances du robot dans le contexte de l'hôpital de jour.
Pour chacune des affirmations, je vais vous demander de vous positionner de 1 à 5 : « 1 » étant le chiffre correspondant à « tout à fait en désaccord » et « 5 » correspondant à « tout à fait d'accord ». Vous pouvez utiliser tous les chiffres 1, 2, 3, 4, 5 pour me dire comment vous jugez les performances du robot. Essayez toujours de me répondre de la manière la plus spontanée possible.

N°	Items	Scores
1	J'aimerais utiliser (parler, se comporter, agir) ce robot à l'hôpital le plus fréquemment possible.	Score – 1
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
2	Je trouve les conversations avec ce robot inutilement complexes.	5- Score
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
3	Je pense que ce robot est facile à utiliser (parler, se comporter, agir).	Score - 1
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
4	Je pense que j'aurai besoin d'aide pour être capable d'interagir (échanger, parler) avec ce robot.	5- Score
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
5	J'ai trouvé que les différents services (fonctions) de ce robot ont été bien pensées (conçus).	Score - 1
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
6	Je pense qu'il y a trop d'incohérences chez ce robot.	5- Score
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		

7	J'imagine que la plupart des gens seraient capables d'apprendre à se servir de ce robot très rapidement.	Score - 1
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
8	J'ai trouvé très difficile de parler et de me comporter naturellement avec ce robot.	5- Score
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
9	Je me suis senti très en confiance en me servant du robot.	Score - 1
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
10	Je pense qu'il y a beaucoup de chose à apprendre pour pouvoir bien se servir de ce robot (parler, se comporter, agir).	5- Score
1 –Tout à fait en désaccord **2** – En désaccord **3** – Moyennement d'accord **4** – D'accord **5** –Tout à fait d'accord		
	TOTAL	
	TOTAL * 2,5	

- **Entretien sur les enjeux éthiques** soulevés par l'introduction du robot à l'hôpital de jour (pour tous les participants).

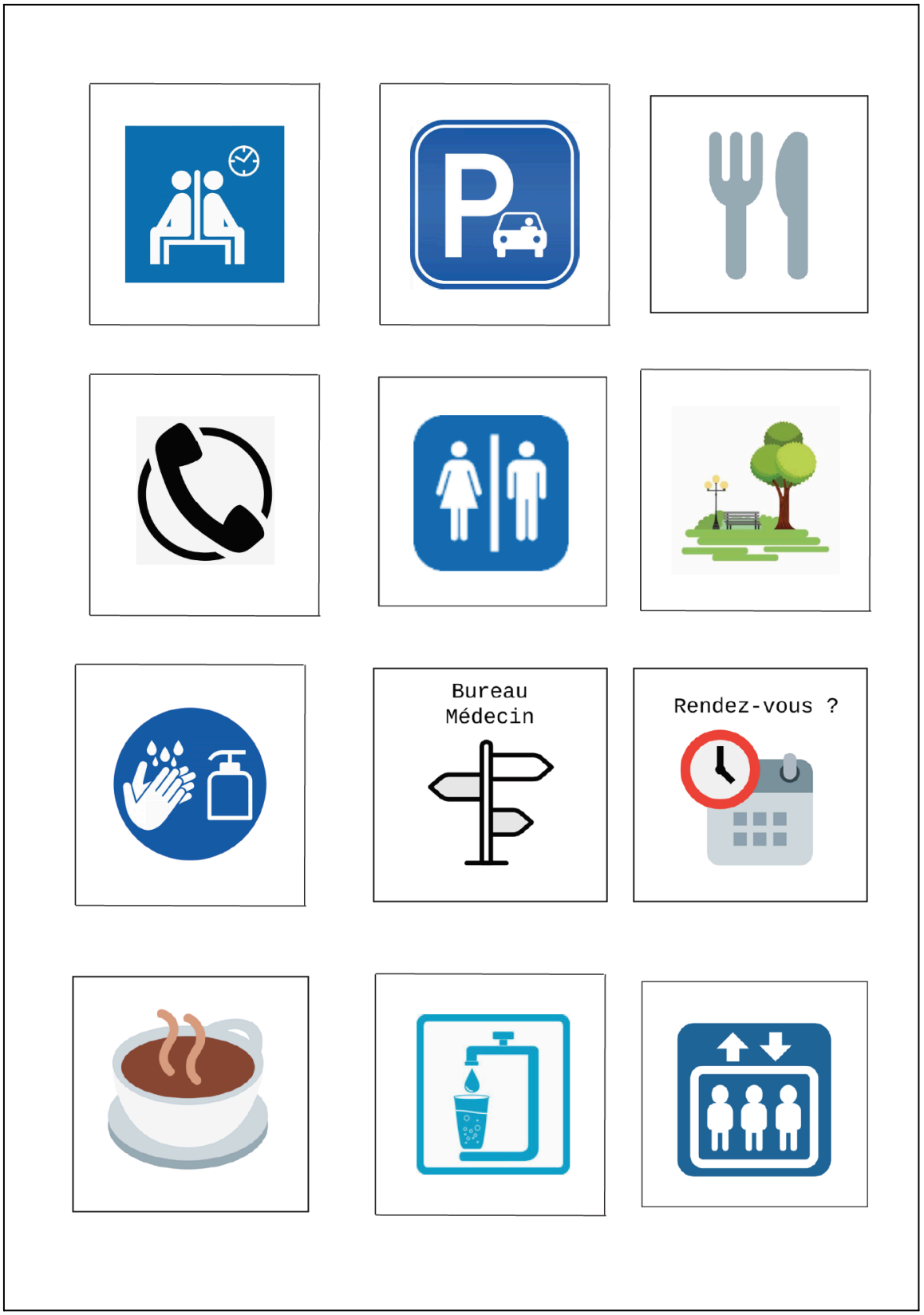
Consignes : Je vous propose maintenant un court entretien autour de 6 questions. Pour chacune d'elles, je vais vous demander votre avis sur les robots sociaux en général. On appelle « robots sociaux », les robots qui ressemblent physiquement à un être humain et qui sont capables d'imiter des comportements humains. Je vous demanderai à chaque fois de justifier votre réponse. Répondez-moi le plus spontanément possible.

N°	Items
1	Approuvez-vous la fabrication de robots qui ressemblent à des humains ? Pourquoi ?
2	Que pensez-vous de l'utilisation des robots sociaux à l'hôpital ? Pourquoi ?
3	Pensez-vous qu'il soit correct/juste (acceptable) que les robots enregistrent et conservent des informations ? Pourquoi ?
4	Vous sentez-vous préoccupé par les erreurs que les robots sociaux pourraient commettre ? Pourquoi ?

5	Pensez-vous qu'il soit possible d'avoir un lien affectif avec un robot ? (éprouver des sentiments, avoir de l'attachement, éprouver de l'empathie) Pourquoi ?
6	Vous sentez-vous inquiet que les robots sociaux puissent remplacer les êtres humains. Pourquoi ?

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Annex 5. Example Task Sheet



Annex 6. Consent form - original French version

IDRCB 2020-A02643-36

FORMULAIRE DE CONSENTEMENT

« Un robot social d'accueil pour les établissements de santé gériatrique » (SPRING)

Je soussigné : (Nom, prénom) ……

Accepte librement de participer à la recherche intitulée : SPRING, organisée par l'Hôpital Broca (APHP), sous la responsabilité scientifique du Professeur Anne-Sophie Rigaud. Dans le cadre de cette étude, j'autorise les chercheurs à recueillir les données me concernant, nécessaires à l'étude, comme défini dans la note d'information ci-dessus.

- J'ai pris connaissance de la note d'information de l'étude SPRING à destination des professionnels, m'expliquant l'objectif de cette étude, la façon dont elle va être réalisée et ce que ma participation va impliquer.
- J'ai reçu des réponses adaptées à toutes mes questions.
- J'ai disposé d'un temps suffisant pour prendre la décision de participer à cette étude.
- J'ai compris que ma participation est libre et que je pourrai y mettre fin à tout moment, sans que cela n'ait aucune conséquence.
- J'ai bien compris mes droits garantis quant à l'utilisation des données recueillies dans le cadre de cette étude.
- Le consentement à ma participation ne décharge en rien le chercheur principal, de l'ensemble de leurs responsabilités et je conserve tous mes droits garantis par la loi.
- Je conserverai un exemplaire original de la présente note d'information et du formulaire de consentement.

Fait à ..... , le ……/……/2024,

Signature de la personne participant à l'expérimentation, précédée de la mention « Lu et approuvé »

Je soussignée Lauriane Blavette (chercheur principal ou son représentant) certifie avoir informé et recueilli le consentement de la personne susmentionnée selon les dispositions du 3 de l'article L. 1121-1 du code de la santé Publique.

Document réalisé en 2 exemplaires. Un exemplaire doit être conservé 15 ans par l'investigateur, le deuxième doit être remis à la personne participant à la recherche.

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Annex 7. Authorisation form for the use of images and the voice - original French version

IDRCB 2020-A02643-36

AUTORISATION DE DIFFUSION DE L'IMAGE /DE LA VOIX

(Personne majeure ou mineure émancipée ou sous tutelle)

Je soussigné(e),

Nom : .....

Prénom : .....

Date de naissance : .....

Email : .....

Déclare être : majeur(e) mineur(e) émancipé(e)

Atteste avoir participé à l'activité « SPRING » engagée par le Broca Living Lab associé à l'Assistance Publique - Hôpitaux de Paris (AP-HP) et conduisant à des communications sur la robotique sociale d'assistance. Dans ce cadre, a autorisé le Broca Living Lab et l'AP-HP à capter et à diffuser mon image et/ou ma voix et ce sur tout support et par tout moyen de communication.

Autorise le Broca Living Lab, et l'AP-HP a reproduire mon image et/ou ma voix telle qu'elle apparaît dans l'activité et à diffuser mon image et/ou ma voix sur internet ainsi que de partager ce reportage sur les réseaux sociaux (notamment mais sans que cette liste soit limitative) ou sur les sites de partage de contenus (notamment mais sans que cette liste soit limitative), et ce dans le seul but de communiquer sur le contenu de l'activité

Cette autorisation est valable pendant une durée de cinq (5) ans, reconductible par accord tacite. Elle est consentie à titre gracieux et n'ouvrira droit à aucune rémunération directe ou indirecte d'aucune sorte.

Les légendes ou commentaires accompagnant la reproduction et la représentation de mon image et/ou de ma voix ne devront pas donner lieu à une exploitation susceptible de porter atteinte à ma vie privée ou à ma réputation, ou à toute autre exploitation préjudiciable.

J'ai été informé(e), conformément à la loi du 6 janvier 1978, le Broca Living Lab et l'AP HP mettront en œuvre un traitement de données à caractère personnel me concernant afin d'exécuter et gérer la présente autorisation. Les données collectées dans ce cadre sont obligatoires pour permettre la diffusion de mon image et/ou de ma voix. Je dispose d'un droit d'accès, d'interrogation, de rectification et d'opposition pour motif légitime au traitement des informations me concernant. Je peux exercer ce droit auprès du Broca Living Lab ou de l'AP-HP.

Je reconnais être entièrement investi(e) de mes droits personnels. Je reconnais expressément n'être lié(e) par aucun contrat exclusif pour l'utilisation de mon image et/ou de ma voix.

Fait à ..... , le ……/……/2024,

Signature:

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Annex 8. Observation booklet (inclusion criteria, socio-demographic data, ATI scale, knowledge of social robots) (professionals) - original French version

IDRCB 2020-A02643-36

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

UN ROBOT SOCIALEMENT PERTINENT POUR L'ACCOMPAGNEMENT DES SOINS GERONTOLOGIQUES
« **SOCIALLY PERTINENT ROBOT IN GERONTOLOGICAL HEALTHCARE**»
SPRING

Cahier d'observation
Professionnels de santé

Code participant (à compléter par le chercheur) : ……..……

Catégorie du participant : Professionnel

Investigateur coordonnateur
Pr Anne-Sophie Rigaud
Chef de pôle gérontologie
Hôpital Broca, Hôpitaux Universitaires Paris Centre,
Assistance Publique – Hôpitaux de Paris (AP-HP)
54-56 rue Pascal, 75013 Paris
Tél : 01 44 08 35 03
Courriel : anne-sophie.rigaud@aphp.fr

IDRCB 2020-A02643-36

Date d'inclusion : ……/……../2024 **Code participant** *(à compléter par le chercheur)* : ……

CRITÈRES D'ÉLIGIBILITÉ PROFESSIONNELS

		OUI	NON
1.	Être majeur		
2.	Ayant exprimé son consentement à participer à l'étude		

DONNÉES SOCIODÉMOGRAPHIQUES

Année de naissance : ……

Genre : □ Homme □ Femme □ Autre (précisez) : .. ……

Niveau d'étude :

□ Diplôme d'études secondaires (baccalauréat)
□ Certificat professionnel (cap)
□ Diplôme universitaire (bts/licence)
□ Diplôme universitaire avancé (master/doctorat)

Profession : ……

Dans quel service travaillez-vous à Broca ? ……

Nombre d'années d'expérience : □ Moins de 5 ans □ Entre 5 et 15 ans □ Plus de 15 ans

INTÉRÊT POUR LES NOUVELLES TECHNOLOGIES

Veuillez indiquer votre degré d'accord ou de désaccord avec les affirmations suivantes. *Par nouvelles technologies, nous entendons tout dispositif ou ensemble d'éléments interconnectés conçus pour réaliser une fonction spécifique, comme des ordinateurs, smartphone, machines, logiciels, etc.*		Pas du tout d'accord	Plutôt pas d'accord	Ni d'accord, ni en désaccord	Plutôt d'accord	Tout à fait d'accord
01	J'aime passer beaucoup de temps avec les nouvelles technologies.	☐	☐	☐	☐	☐
02	J'aime tester les fonctionnalités des nouvelles technologies.	☐	☐	☐	☐	☐
03	Lorsque j'utilise des nouvelles technologies, c'est parce que je suis obligé(e) de le faire.	☐	☐	☐	☐	☐
04	Lorsque j'ai une nouvelle technologie en face de moi, je teste ses fonctionnalités de manière exhaustive.	☐	☐	☐	☐	☐
05	J'aime passer du temps à me familiariser avec les nouvelles technologies.	☐	☐	☐	☐	☐
06	Cela me suffit qu'une nouvelle technologie fonctionne; je ne cherche pas à comprendre comment.	☐	☐	☐	☐	☐

IDRCB 2020-A02643-36

Veuillez indiquer votre degré d'accord ou de désaccord avec les affirmations suivantes. *Par nouvelles technologies, nous entendons tout dispositif ou ensemble d'éléments interconnectés conçus pour réaliser une fonction spécifique, comme des ordinateurs, smartphone, machines, logiciels, etc.*		Pas du tout d'accord	Plutôt pas d'accord	Ni d'accord, ni en désaccord	Plutôt d'accord	Tout à fait d'accord
07	J'essaie de comprendre exactement comment fonctionne les nouvelles technologies.	☐	☐	☐	☐	☐
08	Cela me suffit de connaître les fonctionnalités de base des nouvelles technologies.	☐	☐	☐	☐	☐
09	J'essaie d'utiliser pleinement les fonctionnalités des nouvelles technologies.	☐	☐	☐	☐	☐

Dans votre quotidien, quelles technologies utilisez-vous ?

□ Smartphone □ Ordinateur portable □ Ordinateur de bureau □ Tablette □ Jeux vidéos

□ Autre (précisez) : ……..……..

A quelle fréquence utilisez-vous les technologies dans le cadre de votre travail ?

□ Jamais □ Parfois □ Souvent □ Toujours

Lesquelles :

……..……

CONNAISSANCES SUR LES ROBOTS SOCIAUX ET D'ASSISTANCE

Connaissez-vous les robots sociaux et d'assistance ? □ Oui □ Non

Si oui, lesquel(s) : ……..……

……..……

Utilisez-vous, ou avez vous déjà utilisé, des robots sociaux et d'assistance dans votre pratique professionnelle ? *(exemples : robot d'assistance, robot humanoïde, robot animaloïde)*

□ Jamais □ Quelque fois □ Souvent □ Tout le temps

Si oui, lesquel(s) : ……..……

……..……

Utilisez-vous des assistants vocaux (Alexa, Siri, Google Assistant, Bixby) dans votre vie personnelle ?

□ Jamais □ Quelque fois □ Souvent □ Tout le temps

Si oui, lesquel(s) : ……..……

……..……

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 871245.

Annex 9. Interview guide for professional interviews on organisational, ethical and social aspects, original French version

Guide d'entretien pour les professionnels de santé (SPRING)

EuNetHTA : Éthique

1. Quelle est la **balance bénéfice/risque** (quels risques et quels bénéfices voyez-vous ?) **pour les professionnels ou pour l'hôpital** lors de l'intégration du robot à l'hôpital ? (faire attention d'avoir des exemples de risques et de bénéfices)
2. Quelle est la **balance bénéfice/risque pour les patients et les accompagnants** (quels risques et quels bénéfices voyez-vous ?) lors de l'intégration du robot à l'hôpital ? Pouvez-vous donner des exemples ?
3. Est-ce que le robot ARI peut être utilisé **auprès d'une population vulnérable ?** (personnes avec troubles cognitifs, personnes en situation de handicap, etc.) ?
4. Est-ce que l'utilisation d'un robot comme ARI pourrait **porter atteinte à la vie privée des patients et/ou des accompagnants** (ex : collecte des données) ? Et pour vous, en tant que professionnel ?
5. Est-ce que l'introduction d'un robot de ce type à l'hôpital peut **remettre en question les valeurs des soignants** (bienveillance, respect, écoute, compréhension, altruisme, générosité, dévouement) ? Pouvez-vous donner des exemples ?
6. D'après-vous, l'usage des robots pourrait-il **réduire ou au contraire augmenter l'autonomie des patients et des accompagnants** pendant leur séjour à l'hôpital ? O/N ? Pourquoi ? Pouvez-vous donner des exemples ?
7. Pensez-vous que l'intégration d'un robot, comme ARI, pourrait **créer des inégalités** quant à l'accès aux informations et aux services de l'hôpital ? (exemple : entre les gens qui utiliseraient ou non le robot, personnes plus à l'aise avec la technologie) ?

EuNetHTA : Organisationnel

8. Pensez-vous qu'un robot comme ARI **pourrait être accepté par les équipes de l'hôpital** ?
9. Quels seraient les **freins principaux** à l'intégration du robot dans les services de l'hôpital (technique, SAV, formation, questions réglementaires, réception par les patients, etc.) ? Comment y pallier ?
10. Dans le futur, **comment votre travail pourrait-il changer** si ce type de robots était intégré à l'hôpital ?
11. Comment pourrait-on bien **former les professionnels** à l'utilisation de ce type de robot ?
12. Quel pourrait être **l'impact budgétaire** d'intégrer des technologies comme un robot à l'hôpital ?

EuNetHTA : Sociale

13. Comment pensez-vous que la **présence du robot sera accueillie par les patients et les accompagnants** ?
14. Quels types d'informations devraient être données aux patients et aux accompagnants concernant la présence et l'utilisation du robot à l'hôpital ?

15. Aujourd'hui, **pensez-vous que les équipes de l'hôpital seraient prêtes à intégrer ce type de dispositif** dans leurs **pratiques quotidiennes** ? O/N Pourquoi ?
16. Quelles mesures organisationnelles pourraient favoriser l'intégration d'un robot comme ARI à l'hôpital ?

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Annex 10. Flyers available in the Daycare Hospital - original French version

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

HÔPITAL DE JOUR

REJOIGNEZ NOTRE ETUDE AVEC LE ROBOT ARI

Présentation du projet

Cher patient, cher accompagnant,
Vous attendez à l'Hôpital de Jour de l'Hôpital Broca ?
Nous vous invitons à venir participer à notre étude innovante avec le robot ARI.

Qu'est-ce que l'étude implique ?

- Interagissez avec le robot ARI ;
- Réalisez un entretien pour partager vos impressions et votre expérience avec ARI et nous aider à améliorer ses fonctionnalités.

Votre participation est précieuse pour nous aider à améliorer l'accueil aux patients et le développement de la robotique dans le domaine médical.
Nous nous réjouissons d'avance de vous accueillir pour cette étude.

Informations pratiques

- Tous les lundis, mardis et jeudis après-midi
- Environ 30 minutes
- Hôpital de Jour de l'Hôpital Broca

Pour toute information complémentaire, venez nous voir !

Email & Site internet
contact@brocalivinglab.org
brocalivinglab.org

Broca Living Lab
Hôpital Broca
56 Rue Pascal,
75013 Paris

Contactez-nous
Lauriane Blavette
(Ingénieur de recherche)
Lauriane.blavette@aphp.fr