International Journal of Social Robotics (2026) 18:44
https://doi.org/10.1007/s12369-026-01372-4

Relational autonomy with robots. A focused ethnography of meal assistance robots

Núria Vallès-Peris[1] · Cristian Barrué[2] · Guillem Alenyà[3]

Received: 20 August 2024 / Revised: 27 January 2026 / Accepted: 28 January 2026

Abstract

This paper explores the relationship between meal-assistance robots (MARs) and patient autonomy through a focused ethnography of a pilot experiment in a palliative care hospital. Drawing on the theoretical approach of Science and Technology Studies (STS), the study challenges the dominant dyadic model of human-robot interaction by proposing a relational framework that emphasizes the robot's integration within the patient's broader care network. While MARs currently have limited functionality for enabling autonomous eating in patients with severe mobility problems, participants reported enhanced well-being and expressed a strengthened sense of autonomy through their interactions with the robot. By integrating the notion of relational autonomy with a sociotechnical lens, the study demonstrates that the robot's impact on autonomy is not solely a function of its technical capabilities but is co-produced within the care context. Central to these results is the notion that we call the robot's *heteronomy capacity*—its ability to interact with and adapt to multiple agents and contexts. These findings contribute to a shift in the ontology of socially assistive robots (SARs), highlighting how robotic agency is dynamically produced through socially embedded interactions. The research underscores the importance of interdisciplinary approaches in MARs design and healthcare implementation, advocating for flexible systems that are open to relational heteronomy as a means of supporting patient autonomy and well-being.

Keywords Meal assistance robots · Feeding robots · Autonomy · Science and Technology Studies · Heteronomy

1 Introduction

Healthcare systems around the world are facing a complex problem characterized by an increase in the demand for care and worsening outcomes in some key health indicators, even in high-income countries [1]. Faced with this situation, digitalization is proposed as part of the solution to what is known as a 'care crisis' [2]. Although it is far from being a consensus on the causes and solutions to such a crisis [3, 4], over the last few decades, research in robotics applied to the healthcare field has intensified. These types of robots are known as Socially Assistive Robots (SARs). SARs are complementary to the more established field of rehabilitation robotics, wherein robots provide hands-on assistance, typically through perception and application of force to affected limbs [5]. In contrast, SARs use methods for monitoring, coaching, and companionship to support convalescence or training, as well as giving some kind of support for activities of daily living (ADLs). ADLs include fundamental skills needed to manage basic physical needs,

✉ Núria Vallès-Peris
nuria.valles@iiia.csic.es

Cristian Barrué
cbarrue@iri.upc.edu

Guillem Alenyà
galenya@iri.upc.edu

1 Artificial Intelligence Research Institute, Spanish National Research Council (IIIA-CSIC), BarcelonScience and Technology Studies Group (STS-b), Universitat Autònomde Barcelona, Campus de la UAB, Bellaterr(Barcelona) 08193, Spain

2 Institut de Robòtica i Informàtica Industrial, Universitat Politècnica de Catalunya (IRI-UPC-CSIC), Carrer Llorens i Artigas 4-6, Barcelona 08028, Spain

3 Institut de Robòtica i Informàtica Industrial, Spanish National Research Council (IRI-UPC-CSIC), Carrer Llorens i Artigas 4-6, Barcelona 08028, Spain

Published online: 28 January 2026

comprising grooming/personal hygiene, dressing, toileting/continence, transferring/ambulating, and eating [6].

In this paper, we present a focused ethnography of a pilot experience with a robot designed for the ADL of feeding -a Meal Assistance Robot (MAR)- with the main aim to analyse how such artifacts could enhance or not affect patients' autonomy and well-being. Although feeding robots are sometimes framed in regulatory and engineering literature as medical devices, they can also be conceptually situated within the domain of SARs. As explained, SARs are defined as systems that provide assistance to users primarily through social interaction rather than through physical manipulation or force-based rehabilitation [7]. Their core purpose is to support users' functional abilities, motivation, autonomy, and well-being in everyday contexts, particularly in relation to ADLs [8]. Eating is a core ADL, and assistance with feeding directly aligns with the SAR objective of enabling users to maintain functional abilities and dignity in routine practices. Moreover, prior work emphasizes that SARs need not rely exclusively on verbal or emotional interaction but may also structure, guide, and scaffold daily activities in socially meaningful ways [7, 9]. From this perspective, a MAR is understood as socially assistive insofar as it mediates a fundamental care practice, whose effects are produced through interaction with users and care environments, rather than solely through their mechanical or medical functions [10].

This qualitative research, based on an ethnography, advances the understanding of the relationship between robots and patients' autonomy, proposing a relational framework in which a robot's effects on patients' autonomy emerge through dynamic, context-sensitive engagement with the network of healthcare practices and relations. This reflects a shift toward a new ontology of SARs, where the robot's agency is co-produced in multiple interactions and contingent upon the social environment. The study's results underscore the importance of interdisciplinary research and healthcare programs' responsiveness to robots' design. This suggests that the future of MARs (and SARs in general) must balance technical development with the openness to adapt to multiple agents and contexts. This flexibility and openness to interact with multiple agents is what we named the "heteronomy" capacity of the robot, a robot's ability that enhances patients' autonomy and well-being.

Beyond the technical challenges that the development of MARs entails [11–13], the ethical controversies and debates on the modes of care relations surrounding such artifacts also represent a major challenge, with the debate around autonomy being of particular importance [14]. From a traditional bioethical approach to autonomy, the relations of patients with digital health technologies tend to take a risk-benefit approach, positioning the human subject as a rational, autonomous agent who is acted on by technologies [15]. In the domain of assistive/care robots, this traditional approach has principally focused on the risks for humans and their self-determination to interact with robots, identifying four areas especially sensible: deception, and warning about the risk that some dependent people are unable to understand the artificial nature of the robot [16, 17]; the replacement of humans by robots [18, 19]; privacy [20], and the need to distinguish between privileged information and information that can be distributed [21] and; responsibility in case the actions of a robot caused some kind of damage or harm [22]. These risks should not be underestimated. However, the current state of assistive robots [2] and the MAR used in the experiment is far from such considerations. Although the development of this type of artifact is undisputed, their ability to be used daily in contexts outside the laboratory or experimental processes is currently limited to performing care tasks on their own [23], at the same time that it is recognized the relevance of contextual and activity-related factors in the effective use and adoption of assistive robots, i.e. in assistive robotic arms [24].

Despite the identified need to develop interdisciplinary studies that integrate social sciences and humanities to improve robots' social interaction capacity and ensure that they are responsive to the guiding values of healthcare practice (patients' autonomy among them) [25], the number of empirical studies that analyse the forms of interaction and social effects of using feeding robots from an interdisciplinary approach is limited. Our study addresses this gap by conducting ethnographic research on the experimental process of testing a MAR in a palliative hospital, a real-world healthcare setting outside the robotics lab. Research in real-world settings has been fruitful in robotics [26–28] and its use with SARs combined with ethnographic methods, although scarce, has been demonstrated to be particularly useful for analysing the social effects of such artifacts [10].

Our theoretical approach for interpreting the results is grounded in Science and Technology Studies (STS). STS is a rich and diverse interdisciplinary field born in the 80s, bringing together scholars from philosophy, sociology, anthropology, engineering, and other disciplines to study science and technology. STS examines the social dynamics and practices that create and maintain technologies alongside the meaning and effects of those technologies in the world [29]. From an STS perspective, technologies are not mere tools that we use for different tasks but are active agents that structure our lives, organize our relationships in the world, and give meaning to our relations [30]. When technologies are used, they always help to shape the context in which they fulfil their function. They help to shape human actions and perceptions and create new practices and ways of living. Bruno Latour [31] calls this phenomenon "technological mediation": technologies mediate the experiences and practices of their users. Thus, when analysing the use of SARs in a hospital, the focus of attention from STS is on the way such device transforms care relations, create new assistive practices, or reconfigure how we understand disability or autonomy [23, 32, 33]. It is the relational component of robots designed for performing caring or assistive tasks [34]. For this reason, it is argued by STS that a robot is not an isolated artifact made up only of wires, algorithms, and casings with a series of functionalities [25], but a conglomerate of material, social, and semiotic relations in which technical, scientific, political, economic, social and ethical considerations are intimately entwined [31]. Based on this idea of technology as a mediator, a robot is not simply a solution to a given problem (the support to the realization of ADLs by oneself, for example), but rather a proposal of a model of society and social relations. Following this approach, the introduction of a MAR in the everyday hospital setting will not only facilitate the task of feeding a patient but will also transform how good care or fairness is understood, the organization of care tasks in the hospital, or the relationships of relatives and hospital staff with the patient.

2 A Focused Ethnography of Using a MAR in a Palliative Hospital

2.1 Methodology

The study presented is a focused ethnography of an experiment using a MAR in a palliative hospital. The method of focused ethnography is a kind of ethnography that is particularly, though not exclusively, adopted in applied research. Ethnography is a research strategy that relies on a relatively long-term data collection process, takes place in naturally occurring settings, relies on participant observation, employs a range of types of data aimed at documenting what goes on, and emphasizes the significance of the meanings people give to objects, themselves and the activities around them [35]. Although definitions and features to ethnography are not exempt from discussion in the context of ethnographers' paradigm wars of the last 50 years, the use of ethnography can be understood as a research strategy committed to the following assumptions [35]:

1) *That direct observation by a researcher is more likely to produce data that will enable accurate documentation of what people do, how they do it, and/or why, as against relying solely on people's own accounts about this […].*
2) *That observation in naturally occurring settings will be more informative than elicitation of data in situations that are strongly structured by the researcher, whether via interviews, questionnaires, or experiments […].*
3) *That the accounts of participants collected in the course of participant observation are more likely to be valid […], because accounts are context-sensitive, and tend to be related to features of the lives of participants of which the researcher would be unaware without participant observation* [43:8].

Based on the assumptions of ethnography, focused ethnography is characterized by relatively short-term field visits (i.e., settings that are "part-time" rather than the length of data collection that characterizes conventional ethnographies). As a research method, focused ethnography has been widely used, particularly in research fields specific to contemporary society, which is socially and culturally highly differentiated and fragmented [36]. For this reason, focused ethnography has been selected for the research, as the analysis of situations in which MARs are used for people with disabilities with reduced mobility occurs only in pilot and highly experimental contexts, delimited in space and time, in which various individuals with distinct roles and activities participate. We conducted the focused ethnography at the intermediate care facilities hospital *Parc Sanitari Pere Virgili (PSPV)*, Barcelona (Spain). PSPV is a public hospital specializing in geriatrics and palliative care, with a capacity of 366 beds, mainly aimed at geriatric rehabilitation (277 beds) and long-term care (27 beds). Approximately 50% of the patients in PSPV need assistance with feeding. The experiment with the robot and the ethnographic research was approved by the Ethics Committee of the hospital PSPV, and all the patients who participated in the study approved an Informed Consent.

Our analysis follows a theoretically informed ethnographic methodology [37], characterized by a dynamic and dialectical relationship between empirical data and theoretical frameworks. Rather than applying theory in a rigid, top-down manner, we engaged in a continuous, iterative process that moves back and forth between inductive observations and deductive reasoning. This two-way engagement allowed us to interpret field data through the lens of theory while remaining attentive to how empirical findings might challenge, refine, or extend theoretical assumptions. The aim was to establish analytically productive connections between lived experience and conceptual understanding, integrating theory in a grounded yet generative way throughout the analysis.

2.2 Description of the Robot and the Experimental Process

An ethnography of the experiment that took place at the PSPV with a robot named 'Nyam' was carried out. Nyam is a robot designed to aid in the feeding process for individuals, equipped with a mechanism to effectively recapture the person's attention whenever necessary. The mechanism is easily adjustable by the caregivers, allowing the straightforward customisation of the feeding service. The robot and the testing experiment were designed through a collaborative process with healthcare staff from the PSPV and a team of roboticists (two of them authors of this paper). The team of PSPV comprised physicians, nurses, nursing aides, occupational and speech therapists, a nutritionist and a psychologist. The commercially available Obi device (Fig. 1, left), previously tested and validated for feeding individuals, underwent both software and hardware modifications (Fig. 1, right). An RGB-D camera was added to detect the user's facial location and identify the mouth status and its positional orientation. It was also integrated with a display screen and speaker to provide feedback to the user. The display features a facial representation to add expressiveness to the uttered verbal communications. Additionally, the entire control system has been reprogrammed with new trajectories and dynamics for food collection, encompassing scooping and removing excess food. To guarantee safety, the Obi device tool was attached using a magnet that allowed the tool to detach in case of a collision. It was additionally programmed a torque control watchdog that stops the robot in case maximum torque thresholds are surpassed [13]. To simplify the use of the robot, Nyam only ate from one plate (the Obi commercial product allows eating from 4 plates at the same time) and only used one spoon (to avoid the complications of changing tools). The robot was designed to interact with patients in different ways: one version that spoons the patient by pressing a button, another version that spoons the patient when they gaze at the sensors, and finally, a third version that added verbal interaction to the interaction through gazing (Table 1).

As only one robot was available for the experimentation and to minimize the intrusion in their daily eating routines, the number of patients with the MAR was limited to one patient per day. The robot was programmed to be used continuously over five days (five meals) per patient to reduce the novelty effect. PSPV research team selected 9 patients with severe upper trunk mobility problems, and each variation of the robot was used with 3 patients during snack time to eat yogurt. 3 women and 6 men participated in the experiment, ranging from 52 to 86 years old. The patients selected were able to move the trunk to lie on the bed, as well as articulate the hand a little to press the button. Patients with dysphasia, dementia, a diagnosis of hyper- or hypo-active delirium, with a low level of consciousness, or in the last days of the end-of-life phase were excluded from participating in the pilot experience with the robot. A total of 45 MAR feedings were performed (with 9 patients in total, 3 patients with each variation of the robot, for a total data collection of 15 feedings performed with each variation of the robot).

2.3 Collected Data

As a characteristic of focused ethnographies, the relatively short-time field visits (in contrast with conventional ethnographies) are typically compensated by the large amount of data and the intensity and scrutiny of data analysis [36]. The main methodological tool used for the ethnographical analysis was the participant observation of one of the 4^{th} or 5^{th} meals of each patient ($n=9$) to gather information on the interaction of the patient with the feeding robot, focusing on how the interaction with MAR contributes to the autonomy and well-being of the patient. At least the patient, the roboticist, the nurse, and the health assistant participated in each of the meals during the experiment. All tests were performed in the patient's room, which was shared with another patient, who was also in the room. The presence of other people was

Fig. 1 Obi robot unmodified (left) and Nyam -Obi robot with modifications (right)

Table 1 The three levels of varying autonomy of the feeding robot

Robot's version	Characteristics
A. Button-controlled robot	This robot has a single button that manages the feeding of the patient. In this robot the flow of operation is as follows: when pressing the button, the robot takes the food from the plate; when pressing again the spoon is brought closer to the user to a fixed position; when pressing a third time the robot will go back to the start, and repeat. This mimics the behaviour of the OBI robot with factory settings.
B. Gesture-controlled robot	This robot uses the detection of the patient's facial gestures to choose the next action to perform within the same loop explained for the button-controlled robot. This robot uses the RGB-D camera to always monitor the position and orientation of the patient's face. The flow of operation is as follows: when the patient looks at the robot it takes food from the plate; when it opens its mouth it offers the food to the patient; and when it takes food from the bowl the robot returns to the beginning, and repeats. The trajectory used in each case to feed the patient is chosen from a series of predefined trajectories, in each case being the trajectory closest to the user's mouth.
C. Verbal interaction robot	On the previous basis, the following modifications are added: Timeout system to stay in each action in a limited way before requesting interaction with the user; System to show facial expressions on the screen; Additional gestures with the robotic arm to interact with the patient and; Adaptive capacity to become more or less interactive depending on the patient's behaviour. The following levels of verbal interaction are defined: - Start of the meal: The robot introduces itself, greets you and takes the spoon. - Offering food: Level 0: The robot does not interact with the person; Level 1: The robot gives an indication that it is necessary to continue eating; Level 2: The robot moves (+ voice) to give an indication to the patient to continue eating. - Finishing eating: The robot indicates that the dish is finished.

not limited during the meal, so the patients' companions or visitors (family members) could be in the room, and other hospital professionals (attracted by the novelty of having a robot) came in and out of the room. All observations were gathered in a field diary.

This data is complemented by supplementary data gathered during the experimental project: robot data records of the meals, manual collection of quantitative data on the meals with MAR and semi-structured interviews with patients. This supplementary data includes:

– Robot data records during the meals ($n=45$ - data collection of 9 patients, each one using the robot during the meal for 5 days): Efficiency variables of the robot during the feeding assistance. The variables for assessing the efficiency of the robot when feeding are: total duration of the meal (time in seconds from the beginning to the end of the meal), number of servings (during one meal), cadence (servings per minute) and loss of attention (number of times the user's attention has been lost).
– Manual collection of quantitative data during sessions ($n=45$) on: The amount of food (weight difference between the beginning and the end of the meal), coughing (number of times the patient coughed), vomiting (number of times the patient vomited), food aspiration (number of times the patient had food aspiration), and fever after the experimental process.
– Interviews ($n=9$): An unstructured face-to-face interview was conducted with each patient on the 4th or 5th day of their meal. In the interviews, patients were asked about their opinion on how the MAR facilitated autonomy and their positive or negative assessment of the interaction with the robot. Unstructured interviews are open-ended, based on the participant's previous answers and flow like a conversation. This type of interview was selected because of the health characteristics of the patients, who, in many cases, were very weak and tired when speaking or spoke very softly. The interviews were audio-recorded, and a summary transcript combined with a verbatim transcript of the most significant excerpts was made. Given the patients' health and the limitations of data that could be obtained from the interviews, the main source of information on the patient's perspective was the observation of meals with the robot, using the interview data as a supplement.

3 Autonomy with MARs

In the last fifty years, bioethics has witnessed a development towards more patient autonomy in health care. Some scholars consider that replacing the centrality of beneficence with the principle of autonomy can be viewed as the most radical in the long history of the Hippocratic tradition [38]. The bioethical concept of autonomy recognizes the human capacity for self-determination and that such capacity ought to be respected. However, like many other moral concepts, such as justice or equality, autonomy derives its meaning from particular theoretical perspectives [39].

This section presents the results as a dialectical relationship between empirical data and theoretical framework, as defined by informed ethnographic methodology [37] and follows a narrative that uses various theoretical models of approaching autonomy. In Sect. 3.1. The results are analysed in the light of the traditional model of autonomy, understood as independence and the ability to decide and act without external influence. In Sect. 3.2, given the limitations of this model for understanding patients' relationships with the MAR, the relational autonomy model is introduced.

Abandoning the premise that autonomous agency is atomistic or individual, "relational autonomy" is the term used to designate a variety of conceptions of autonomy, all of which are united in the idea that autonomous beings are, of necessity, socially situated and interdependent, constituted by the societal positions they occupy and the shared environment they inhabit [40]. Finally, Sect. 3.3 elaborates on this model and the effects it has on understanding the impact of the robot on patients' autonomy, as well as for re-conceptualising the very notion of robot autonomy.

3.1 The Model of Individual Autonomy in Human-Robot Interaction

The relationship between the autonomy of social robots and the autonomy of humans has traditionally been understood from traditional bioethics and robotics from two different approaches: (a) as a zero-sum game: more autonomy for robots equals less autonomy for humans because decisions are delegated to robots [41] or; (b) conversely, that by enhancing the autonomy of social robots, human autonomy can be enhanced, as these artifacts enable more valuable ends, enhanced competencies, and more authentic choices [42].

Both approaches are based on the idea of individual autonomy, i.e., that people or artifacts have independence, and for this to be possible, they must be free from coercion or other interference. Generally speaking, from a mainstream bioethical perspective, autonomy is understood as the capacity for self-determination and/or self-governance [43]. In the field of robotics, autonomy is understood as the ability of a computerized artifact to follow a complex algorithm in response to environmental data, independently of human intervention in real-time [44]. This is the model embedded in the traditional conceptualization of Human-Robot Interaction (HRI), based on a dyadic relationship between two rational and autonomous actors [15]. With this approach to the notion of autonomy, the roboticist team designed three variations of the Nyam robot (Table 1) to analyse the relationships between the level of autonomy of the MAR and the autonomy of the patient (a detailed analysis of the Nyam design process and the results of the experiment can be found at [13]).

Observations of the 45 meals with patients with motor impairment show that the robot reliably accomplished its primary purpose of transferring yogurt from the plate to the patient's mouth. In its use, the three robot variants—distinguished by different levels of autonomy—did not give rise to noticeable differences in how feeding was experienced or carried out. The duration of the meals, the succession of spoonfuls, and the general cadence of feeding remained comparable across configurations. Importantly, none of the patients displayed adverse reactions such as coughing, vomiting, aspiration of food, or fever during or following meals assisted by the robot.

During the interviews, patients reported a very positive assessment of autonomy and well-being. The evaluation referred both to their experience of use during the 5 days in the hospital, and to their opinion as to whether the robot could be used more widely in the hospital, or even in their homes. This positive evaluation of their experience of use, associated with autonomy and well-being, was also identified during the observations of the pilot experience with the MAR, in which the patients were joyful (in their comments and gestures with the roboticist, the nurse, or the health assistant) and showed interest in what the robot was doing and how it was operating.

As explained, from a mainstream bioethical perspective, autonomy is understood as the capacity for self-determination and/or self-governance. Individual autonomy, i.e., that people have independence, and for this to be possible, they must be free from coercion or other interference. However, due to the technical limitations of the MAR during the 5 days of the pilot experience, patients could not choose their snack and had to eat a dairy dessert with the robot. That dessert will also not be of choice, as the knowledge about the robot texture adjustment follows an incremental process along the process: the first patients can only snack on skimmed yogurt because other types of dairy that some patients like more have textures that do not work well with the robotic arm (rice pudding, custard or jelly).

> On the first day, we used the custard. And nothing. With the custard, everything fell out of the spoon, it came out empty. Because it was very liquid. The robot has a movement that turns the spoon. I can't make sense of that movement. When the robot picks up the product, it turns the spoon forward [towards the plate so that it doesn't drip when it goes up]. When it turns the spoon, it all goes away and when it goes up, it goes up turned and the custard spills out. [...] When I saw the spoon, I said, 'We haven't finished eating for three days.'
>
> Interview with a patient, a man, 64 years old. The second patient with whom the robot was used.

The latter patients can now eat regular yogurt and chocolate dairy desserts, always of the same brand. In addition, patients sometimes have two snacks: the dairy dessert with MAR and, after half an hour, the conventional hospital snack brought to their room. On the other hand, although depending on the variation of the robot the patient indicates in one way or another (by the button or by looking at the screen) when a spoonful is started, the arm is slow in making the complete movement of take the spoon to the plate-take the food from the plate-go from the plate to the mouth-finally return from the mouth to the plate and start again. From the time the robot has been adjusted, and the snack food begins, eating ½ to ¾ of a yogurt takes at least 10 minutes. In some cases, when the patient is very weak and gets tired when talking or eating, the patient says that enough is enough without finishing the yogurt because he has become tired. In other cases, the last ¼ of the contents of the dish, at least, cannot be taken well with the spoon.

The range of issues that the patient has room to negotiate during the snack with MAR is very limited. The pilot experience in the hospital has involved so many professionals, procedures and routine changes in the health centre. The real possibility that, once the study had begun, there could be a discussion about how the robot would be used and under what conditions is complex. The patient can only negotiate whether to be in bed, upright or sitting, depending on how they are that day. However, everything regarding the number of people who will be present in the room during the interaction, the duration of the test each day, or the environmental conditions in which the pilot test is carried out are uncertain issues to which the patient needs to adapt. For example, before starting the snack with the patient, the roboticist spent a while each day calibrating the robot in the room. This process lasted approximately 20 minutes, in some extreme cases lasting 45 minutes. On some occasions, we were waiting for more than 7 people for 20 minutes, in a room shared with another patient. A small room, with no space to move with so many people, the television on, the roommate complaining, the door open and hospital professionals coming in to look. Other times we were only 3 people without any companions or family members in the room. Other times, a hospital director even appeared in the room while the MAR snack test was being done, to greet a patient who usually spent the day alone in his room. These issues, unpredictable and uncertain, are not valued negatively, on the contrary. Multiple unforeseen events occurred during each day, however, the unpredictability generated by the feeding robot in the palliative care hospital was interpreted by patients as positive, although it could not be negotiated or discussed (Table 2).

3.2 The Model of Relational Autonomy

The patients who participated in this pilot experience, all with severe mobility problems or no upper trunk mobility, knew their physical capabilities since one of the conditions for participating in the study was not to have cognitive impairment. Most of the time, in bed in an intermediate hospital room with reduced mobility, the routines that organize the day are ADLs (meals, hygiene, rehabilitation exercises), special tests or treatments, visits, or a walk in the hospital garden. These activities are always done with the assistance of a sanitary assistant, a nurse, or a relative who is visiting the patient, and with the help of mundane technologies [45] (such as a bedpan, a warning button at the head of the bed, nappies, a sock wedge, a bed that goes up and down, a wheelchair, etc.) accompany and make possible the daily life of the patient.

> Patient (P)- I can't even pick up a spoon, a bottle of water, if it's full, I can't lift it, if it's half full, I can't lift it. I can't shave, I can't wash myself, I can't shower […] they have to do everything for me, they have to feed me, they have to cut it, they have to put it in my mouth. And I'm so calm […] I can't break a wall with my head.
>
> Researcher (R) - When they feed you, are you also so calm?
>
> P - Yes yes yes, also so calm. It's very funny because each person who feeds me has their habits […].
>
> R - What do you value in that feeding?
>
> P - That the person who feeds me is comfortable. The important thing is that the person is comfortable. If that person is not comfortable, I will notice that they are not comfortable. And I prefer my assistant to be comfortable.
>
> *Interview with a patient, a man, 74 years old.*

Therefore, what is crucial for the life of a hospitalized patient with reduced mobility is that the network of people and technologies that make their care and assistance possible works. What determines their ability to do things is not self-confidence (whether they have it or not), but confidence in others (humans and technologies) and the correct harmony between the agents.

From an alternative perspective to the traditional account of autonomy as self-governance, respecting the autonomy of the patient involves more than simply not interfering [46], and another account of autonomy is developed, which is known as relational autonomy. From the bioethical approach of relational autonomy that comes from the theoretical tradition of 'the ethics of care' [47], autonomy is not an inherent personal trait but rather a developmental achievement shaped by the networks of interaction that make up social life [48, 49]. It requires social cooperation and supportive networks to be realized [50].

Table 2 Extraction of the notes from the field diary

April 3, 2023. MIGUEL, button-controlled robot
We met outside the Montseny building at 3:50 PM, in the Pere Virgili premises. Present were a nursing assistant who serves meals in the hospital (referred to as TCAI), a nursing resident, and Maria [these three are responsible for the project on behalf of the hospital]. Shortly after, Pau [a psychologist who also works at the hospital on community participation projects) and Marc (the engineer in charge of the robot] joined us. Maria arrived carrying a non-fat yogurt. For now, it seems the non-fat yogurt's texture is the only one the robotic arm can handle. They've tried it with regular yogurt, which doesn't work well, and gelatine and rice pudding are impossible; the rice, being solid, keeps falling off the spoon.
We all went up to the room-seven people in total (the TCAI, the nurse, the roboticist, the psychologist, the researcher who brought the yogurt, me, and another TCAI who joined us along the way and was taking photos with her smartphone for the hospital). We entered Miguel's room. The room is shared by two patients, and the curtain separating the two beds was drawn to avoid disturbing the other patient, who is not part of the study. However, as there were many of us and the middle space of the room (about 3 m × 4 m) was cramped, and hospital staff kept coming in (three more people briefly entered during the session), the curtain would slide open, revealing the neighbouring patient.
When we arrived, the patient in the other bed was silent, but later began groaning, exclaiming "ahh," "uissh." The nurse asked if something was wrong, and the patient said his leg was in severe pain.
From the moment we entered, Marc began assembling the robot. We spent over 20 minutes waiting for him to adjust it. Today, Miguel wasn't feeling well and couldn't sit in the chair beside the bed, where he had used the robot on previous days. As a result, the robot had to be recalibrated for Miguel to use it while reclining in bed. Miguel can only move his head and one hand, which he uses to press the button that activates the robotic arm (this patient uses Model 1 of the robot, the least autonomous version). Marc, calm and patient, worked on calibrating the robotic arm while people came and went from the room, and the neighbouring patient kept complaining about his leg pain.
We moved the bedside table closer to Miguel's bed to place the platform supporting the robotic arm. However, the robot's power cable couldn't reach the outlet from this new position because it was too short. Someone went to fetch an extension cord. The room was small, crowded, and noisy, with the neighbouring patient groaning, the table and chair being moved around, and the television playing loudly in the background (TVs are often on in hospital rooms). After a while, the TV was turned off, but there was still a lot of commotion and noise. Miguel waited, reclining in bed.
To calibrate the robot, Marc sat in the chair next to the bed with the computer on his lap. He kept standing up, holding the computer in one hand and using the other to guide the robotic arm to perform the necessary movements: first, scooping a bit of yogurt, ensuring it didn't fall off the spoon, then moving the arm to Miguel's mouth and stopping it there (Miguel can barely move his head, so the spoon must stop 1–2 cm from his mouth). The arm then had to return the spoon to the dish and repeat the process. While Marc performed these movements with the robotic arm, holding the computer in one hand and repeatedly sitting and standing, most of the other attendees (7 or more) remained silent. The neighbouring patient complained about his leg a few more times.
Miguel was delighted, looking at the "eyes" on the screen attached to the robotic arm, which are non-functional, and making funny faces at them. The attendees in the room watched him and laughed at his antics. Finally, the robot was calibrated, and the test began. Miguel was pleased with his snack of non-fat yogurt, served by the robotic arm. He had asked for custard, but it seems it can't be used for the tests yet. Marc promised to arrive half an hour early next time to try calibrating the robot for custard.
For the next 10 minutes, the robotic arm fed spoonful of non-fat yogurt to Miguel. I won't elaborate on the process—there were no issues. Everyone watched as Miguel ate his snack. The yogurt didn't fall off the spoon, and Miguel kept making funny faces at the robot's static "eyes" (which are only intended to move in the third, more autonomous robot model). After 10 minutes, Miguel was told the robot couldn't scoop any more yogurt from the dish, and the TCAI removed the remaining yogurt.
The equipment was packed up, and everyone left the room except the TCAI and me, who stayed to interview Miguel. Before the interview began, he was served his regular hospital snack: a glass of liquid (it looked like milk or juice) and a small packet of four cookies.

All names are fictitious, to guarantee the anonymity of the participants

This perspective does not question autonomy itself, and what is more, respect for autonomy as the dominant moral value in caring and healthcare relationships is not questioned either [39]. This view contrasts with bioethics traditional formulation of personal autonomy as the individual's capacity to act as an independent decision-maker, uncontaminated by any influence from or concerns about other agents. Integrating the relational approach to autonomy developed from the care perspective of the ethics of care [47], the idea of interdependency as a characteristic of human existence is emphasized. From the care perspective, the ideal of independence as self-sufficiency is fiercely criticized. Instead, the value of depending on others and being depended upon is then recognized [46].

The network of agents involved in daily assistance and help (humans and technological devices) is a fundamental component of being able to perform daily activities and end up becoming oneself. When the robot fits into this network of care it is also received with trust and the robot, like the other elements that are part of the network, becomes part of the patient.

> R - How did you communicate with the robot?
>
> P - Well, you know what happens? You end up doing it a little bit mechanically. When it mixes [the yogurt], as you can see how it has done everything, when it mixes it, you're already waiting for it to open its mouth. When a spoonful comes, you open your mouth and you're already waiting for it to take the spoon away to eat. In other words, it's a bit like being part of the robot yourself.
>
> Interview with a patient, a man, 52 years old.

Therefore, the robot's direct interaction with the patient does not reinforce the patient's self-confidence, but rather the patient's confidence in the care network that cares for and assists them. To have a nuanced comprehension of the relationship of using MARs with patients' autonomy, we must consider that patients not only assess their interaction with the robot as if it were an independent entity of themself (the robot as a separate entity of the patient and its care network). Rather, in addition, patients assess the relationships that the various agents in their care network establish with the robot, as well as their assemblage with the robot, as shown in the above verbatim.

From the idea of relational autonomy, the ideal of autonomy in terms of independence and self-sufficiency is criticized. Instead, an idea of interdependency, descriptively and prescriptively, is emphasized [39]. Interdependency includes patients' relations with technologies that take care of them [51], being autonomy a moral competency that is getting rid of its individualistic connotations and instead becomes a process of relational agency.

Human autonomy is relational and situated [52], while also robots' autonomy could be understood as dependent on the data on which they are based for the actions that such artifacts are capable. Even if new data is included in the decision-making, the data types limit its space for action, which some scholars call *datonomous technology,* a way to emphasize *that 'autonomy'* is not a characterization, feature, or property [52] but a situated process configured by a network of relationships. This approach is in line with STS and a renewed interest in human relationships with machines and things across a range of humanities and social sciences disciplines, directed at analysing health, well-being, and medical care in its relations with healthcare technologies [15], highlighting that receiving and providing care is directed at supporting or improving people's health and wellbeing, in a network of relationships in which participate a multiplicity of actors, human and non-human. This idea can be accompanied by 'relational materialism', according to which the elements do not exist for the reason of any essence but are constituted from the networks of which they are part [53–55]. Humans, as well as autonomy, are positioned as always more-than-human, part of constantly changing assemblages with a variety of heterogeneous human and nonhuman actors (robots among them). In this way, the relational autonomy of bioethicists is widened by the intersections between humans and health technologies [15]. In sum, autonomy is viewed as never pre-existing or as a property of agents (human or robot) but as generated with and through assemblages of humans and nonhumans. In robotics, this approach has been formalized in the notion of a 'Robot Embedded in a Network' (REN) [25], offering an alternative to the traditional view of two independent entities interacting (the HRI model) (Fig. 2a), emphasizing the agency of the network itself (Fig. 2b).

Considering the framework of relational autonomy developed from the ethics of care and relational materialism, we can understand that patients' positive assessment of MAR to their autonomy and well-being is not only based on their experience of direct interaction with the robot but also integrates other elements that configure the context of the interaction.

> R - What would you tell other patients in the hospital about how it has been going these days eating with the robot?
>
> P - If they can eat on their own, better than anything else.
>
> R - Don't you like the robot?
>
> P - No.
>
> R - Don't you think the robot is good?
>
> P - Of course it is.
>
> R - So, is there anything you didn't like?
>
> P - I liked everything.
>
> R - A lot of people came every day.
>
> P - Yes.
>
> R - Did it bother you?

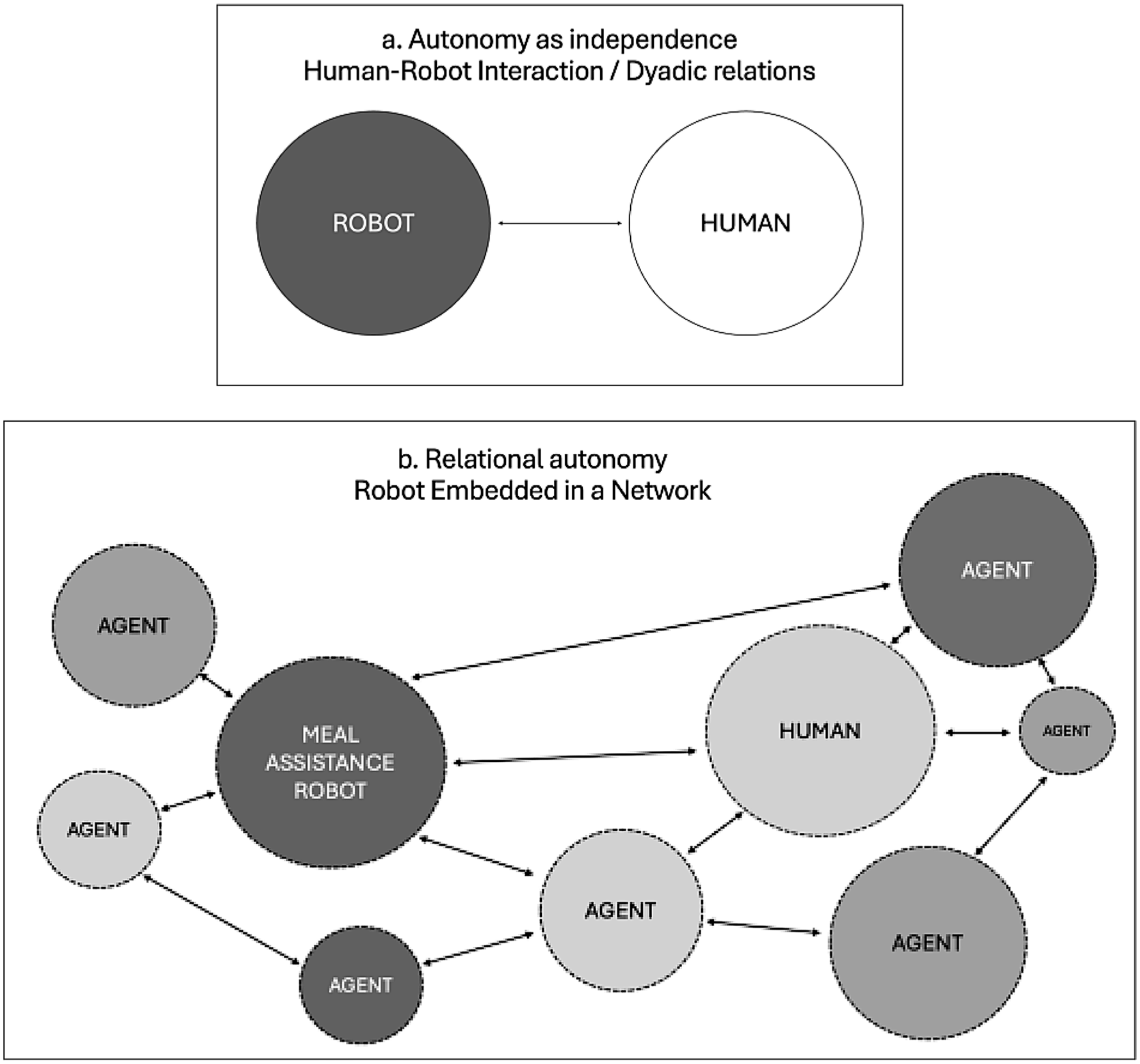

Fig. 2 Two models of autonomy with robots

P - No, why?

R - I don't know. When I come, Marc is also coming, the guy who runs the robot, the nursing assistant, the psychologist … We might bother you.

P – [Silence]

R - Would you like to continue with the robot to eat?

P - Yes, with many people.

R - But do you mean that the robot works for many patients in the hospital, or do you mean all those people who go with the robot?

P - With all these people.

Interview with a Patient, a Woman, 86 Years Old

As shown in the above fragment of an interview with a very weak patient, the robot has facilitated new interactions in the patient's network that enhance her well-being, an agency of the robot that goes beyond the MAR's capacity to feed the patient.

3.3 The Robot's Capacity of Heteronomy

Notably, this redistribution of the agency is not solely attributable to the robot's functionalities but rather to how the pilot's experience with the MAR in the palliative hospital has enabled the establishment of connections among various elements essential to the patient's well-being. Therefore, to analyse how a robot can enhance—or fail to enhance—the autonomy of patients from the perspective of relational autonomy in care, it is necessary to consider the robot's capacity to strengthen the patient's network of relationships.

We name this property the robot's "capacity for heteronomy": heteronomy not as a lack of autonomy, but as the capacity to relate with others - Levinas's "law of the other" [56]. The heteronomy capacity of the MAR refers to two different types of relationships:

On the one side, it concerns the robot's agency in establishing direct relationships with other agents within the network thats sustain patient care. Due to the technical and ethical constraints of the experimental project in the hospital, the robot was always accompanied (at least) by a roboticist and a nursing assistant. This arrangement ensured that the robot remained a "flexible" object, capable of adapting to the room's layout—whether the patient was in bed or seated in a chair—or adjusting to environmental conditions, such as excessive or insufficient light affecting sensor functionality, where someone could draw the curtains if needed. During the trial, the nursing assistant continuously monitored the robot's operation, ensuring it moved at an appropriate speed and checking whether the spoon was clean or properly positioned, among other tasks. This form of agency, therefore, was not inherent to the robot's design but rather stemmed from the deliberate design of the robot's usage experience in the hospital. The constant presence of the roboticist and nursing assistant made the robot adaptable and flexible, fostering an environment of heightened attention toward the patient. Furthermore, the robot attracted the curiosity of the patient's roommate, transforming them into an engaged observer interested in the interactions occurring with the patient. During the pilot experience, some roommates even requested to participate in the study themselves.

On the other side, it concerns the robot's agency in bringing forth and intensifying processes or relationships of assistance and care of the patient.

In the previous paragraph, we discussed how the pilot experience fosters new relationships, with the robot, the roboticist, and the nursing assistant forming an assemblage that enhances the robot's flexibility and generates various interactions. Beyond these direct relationships, however, the experimental project with the robot amplifies other networks of care that are not directly related to the robot but are indirectly reinforced by its introduction. For instance, the integration of MAR in the pilot program increases visits from groups that do not typically come to the hospital to see patients—such as grandchildren who visit their relatives—or video calls from family members interested in seeing the robot in action. Additionally, the MAR project draws broader social attention to the activities of the palliative care hospital.

R - Was there anything you particularly liked about the robot?

P - Well, I liked being. Being with this option. And finding myself with a good option for the future. I liked that.

R - Would you like to add anything else?

P - It's good that they count on me to do things like this.

Interview with a Patient, a Man, 83 Years Old

This attention is particularly significant for patients living with severe illnesses, some of whom are in end-of-life care. Examples include the researchers who participate in the research project, journalists sharing stories about patients' life experiences in the local media, the attraction of funding for the palliative care hospital through innovation initiatives, and the establishment of direct relationships between hospital management and the patients.

The heteronomy capacity of the MAR enables an improvement in the well-being and assessment of the patient's autonomy. This heteronomy capacity of social robots lies not only in the artifact but also in the relationships established for conducting the pilot project between the robotic teams, the hospital, or the social services, raising new challenges in the design of these artifacts; as well as highlighting the necessary linkage of robotics with health and care programs and policies. This network of relationships allows the development of the robot's heteronomy, an interdisciplinary endeavour that enhances the relational and interpellation capacity of these artifacts.

4 Discussion: From Robot's Autonomy to Robot's Heteronomy in Healthcare

Our study confirms the results already identified in other studies on the performance of MARs and the experience of users with reduced mobility: the devices fulfil the functions designed and users show a positive experience with these robots [7, 8, 53]. However, based on the focused ethnography conducted, we show that the positive appraisal of patients on the improvement of autonomy due to the introduction of a MAR is not only explained by the human-patient dyadic interaction. Does this mean that such devices cannot improve the autonomy of patients with some kind of disability or difficulty? Or that if they were able to perfectly execute the function for which they were designed, the robot alone would improve the autonomy of patients? Our research shows that the answers to both questions must be nuanced.

At the outset, there is an aspect that has to do with the context of the study on forms of interaction with MARs, which is being conducted within the framework of a pilot project. Multiple studies have examined the effect of experimental processes on patient assessment and clinical outcomes, known as the Hawthorne effect. The Hawthorne effect is referred to indicate the influence of the experimental effect on the positive appraisals of the participants in a research study, as happens in our pilot study with MARs. In healthcare, the Hawthorne effect has been reported in preoperative studies, interventional studies, and clinical trials [57, 58]. Hence, concluding that the Hawthorne effect can occur when either the patients and/or clinicians are aware of the study conditions. Behavioral change due to an awareness of being observed, active compliance with the supposed wishes of researchers because of special attention received, or positive response to the stimulus introduced, nevertheless, is by no means an equivalent of a placebo effect. As stated from social studies of healthcare, it indicates that other dimensions and relations should be integrated into the analysis to explain the phenomena under study [59], as we do by integrating the notion of relational autonomy.

Feeding robots can improve patients' autonomy, although such autonomy does not depend on the robot being able to perform that function perfectly, even though the robot can play a very important role. In line with the care approach to relational autonomy, autonomy could not be taken as an exclusive attribute of an artifact or an algorithm but is produced in a sociotechnical system in which various actors, institutions, public policies, and robots participate. In other words, ethical and moral controversies related to robotics (i.e., about autonomy) are not limited to the system's design but include such design in its use context in a particular domain [25]. To fully understand and develop the ability of robots to improve patient autonomy and well-being, a paradigm shift in the traditional understanding of autonomy, both patient and of the robot, is needed.

The relationship between MARs and autonomy is more varied and complex than suggested by the approaches based on the idea of individual autonomy expressed in the model of HRI [60]. Our results on the focused ethnography of the experiment with Nyam in a palliative hospital show the robot's ability to interact with the network of care relationships that sustain the patient's autonomy. We refer to this capacity as the robot's heteronomy, emphasizing the need and permanent capacity to establish networks of dependence and interdependence between humans and other humans and with technologies and other agents.

The implications of these results for the conceptualization of novel approaches to the study of relations with robots could be summarized in the following points:

- The patient's capacity for autonomy depends on the connections and relationships with the robot and with various agents that come into play. Whether these relationships foster or constrain self-determination depends on the specific details of how they operate in each situation.
- This network of relationships, which involves a diverse range of agents such as healthcare technologies, healthcare professionals, data analysts, hospital protocols, patients' relatives, etc., provides the conditions for patients' autonomy in a healthcare context [15, 61]. Autonomy is inherently produced through these relationships rather than compromised by them.
- When a MAR is introduced into this care network, it contributes to shaping the context in which it fulfils its function. Robots influence patients' actions and perceptions, as well as the entire network of care, creating new practices and experiences [25, 33].
- The capacity of a robot to enhance a patient's autonomy depends not only on the robot's functionalities and design, but also on the fact that it is dynamic and contextual. It inherently relies on the relationships that the robot can establish with other agents in the network and the potential for other agents to engage with the robot.
- This dynamic and contextual relational capacity of the robot to improve the autonomy and well-being of the patient, its heteronomy, is expressed through two types of interactions: direct (establishing new networks of relationships with agents that improve the autonomy of the robot and the patient) and indirect (intensifying the patient's care networks that facilitate their well-being and autonomy).

It has been in the context of a research process with a robot that has allowed us to identify these dynamics. As these types of robots are deployed beyond pilot projects and experimental settings, more studies will be necessary to compare how relationships with robots differ across contexts, user groups, and healthcare programs.

5 Conclusions

This paper examines whether the introduction of assistive robots, specifically MARs, in a hospital setting can enhance or hinder the autonomy of patients with severely limited mobility. Within the ethnographic study of a pilot experience with a MAR, we show how the dominant traditional approach to autonomy is limiting the analysis of the effects of using feeding robots for patients' autonomy, as well as it is limiting the development of assistive robots. On the contrary, we embrace an alternative approach to the autonomy of humans and robots, relational autonomy, to enhance the potentialities of robotics in healthcare for patients' autonomy and well-being. From this approach, we identify how the capacity of robots to interact with the patient's care network (the robots' heteronomy capacity) can improve the autonomy and well-being of patients. These findings underscore that the robot's effects on patient autonomy are not reducible to its technical functions but are instead emergent, relational, and socially embedded.

In this way, we understand that the fruitful results of the notion of heteronomy in MARs are an interesting starting point to explore autonomy with SARs. There are specific applications in specific contexts that generate continuities and interconnections among various actors, systems, and providers that can enhance patients' autonomy and well-being. Thus, we need a generalised conception of autonomy in robotics that recognizes that a particular design cannot be abstracted from its entwinement in specific contexts and uses and that care with robots calls for collective action that extends beyond the particularity of a single artifact or application but includes healthcare policies and care organizational adjustments that can respond more effectively to patients' complex and evolving needs.

Acknowledgements This work was supported by Project CHLOE-MAP PID2023- 152259OB-I00 funded by the Spanish Ministry of Science, Innovation and Universities (MCIN/AEI/10.13039/501100011033).

Author Contributions All authors contributed to the study conception, design, and fieldwork. The first draft of the manuscript was written by NV-P and all authors commented on and edited previous versions. All authors read and approved the final manuscript.

Funding Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

Data Availability For the ethnographical analysis, we do not analyse or generate any datasets, because our work proceeds within a theoretical and qualitative approach. For information on robots' data records gathered during the experimental process, the authors declare that the data is available within the supplementary information files of this article.

Declarations

Ethical Approval The research was approved by the Ethics Committee of Parc Sanitari Pere Virgili. All the participants in the research approved an Informed Consent.

Competing Interests The authors declare no conflicts of interest.

References

1. Topol EJ (2019) High-performance medicine: the convergence of human and artificial intelligence. Nat Med 25:44–56. https://doi.org/10.1038/s41591-018-0300-7
2. Maibaum A, Bischof A, Hergesell J, Lipp B (2022) A critique of robotics in health care. AI Soc 37:467–477. https://doi.org/10.1007/s00146-021-01206-z
3. Fine M, Tronto J (2020) Care goes viral: care theory and research confront the global covid-19 pandemic. Int J Care Caring 4:301–309. https://doi.org/10.1332/239788220X15924188322978
4. Domènech M, Vallès-Peris N (2023) Robots for care: a few considerations from the social sciences. In: Sikka T (ed) Genetic science and New digital technologies. Bristol University Press, Bristol, pp 180–203
5. Matariæ MJ (2017) Socially assistive robotics: human augmentation versus automation. Sci Robot 2. https://doi.org/10.1126/scirobotics.aam5410
6. Mlinac ME, Feng MC (2016) Assessment of activities of daily living, self-care, and independence. Arch Clin Neuropsychol 31:506–516. https://doi.org/10.1093/arclin/acw049
7. Feil-Seifer D, Matari C, Maja J (2005) Socially assistive robotics. In 9th Int Conf Rehabil Robot ICORR, 2005 IEEE, pp 465–468
8. Broekens J, Heerink M, Rosendal H (2009) Assistive social robots in elderly care: a review. Gerontechnology 8:94–103. https://doi.org/10.4017/gt.2009.08.02.002.00
9. Kidd CD, Taggart W, Turkle S (2006) A sociable robot to encourage social interaction among the elderly. In Proceedings 2006 IEEE International Conference on Robotics and Automation, 2006. ICRA 2006, IEEE, Orlando, FL, USA, 3972–3976
10. Nickelsen NCM (2018) Feeding assistive robotics, socio-technological imaginaries and care: the case of Bestic, REELER Working Paper Series. Aarhus University, in, Copenhagen
11. Feng R, Kim Y, Lee G et al. (2022) Robot-assisted feeding: generalizing skewering Strategies across food items on a plate. Springer Proc Adv Robot 20 SPAR: 427–442. https://doi.org/10.1007/978-3-030-95459-8_26
12. Park D, Hoshi Y, Mahajan HP et al. (2020) Active robot-assisted feeding with a general-purpose mobile manipulator: design, evaluation, and lessons learned. Robot Auton Syst 124:103344. https://doi.org/10.1016/j.robot.2019.103344
13. Barrué C, Suárez A, Inzitari M et al. (2024) NYAM: the role of configurable engagement Strategies in robotic-assisted feeding. In Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction, ACM, Boulder CO USA, 228–232
14. Borenstein J, Pearson Y (2010) Robot caregivers: harbingers of expanded freedom for all? Ethics Inf Technol 12:277–288. https://doi.org/10.1007/s10676-010-9236-4
15. Lupton D (2020) A more-than-human approach to bioethics: the example of digital health. Bioethics 1–8. https://doi.org/10.1111/bioe.12798
16. Sharkey A, Sharkey N (2011) Children, the elderly, and interactive robots: anthropomorphism and deception in robot care and

companionship. IEEE Robot Autom Mag 18:32–38. https://doi.org/10.1109/MRA.2010.940151
17. Sparrow R (2016) Robots in aged care: a dystopian future? introduction. AI Soc 31:445–454. https://doi.org/10.1007/s00146-015-0625-4.Abstract
18. Sharkey N (2008) Computer Science. The ethical frontiers of robotics. Science 322:1800–1801. https://doi.org/10.1126/science.1164582
19. Sharkey N, Sharkey A (2012) The eldercare factory. Gerontology 58:282–288. https://doi.org/10.1159/000329483
20. Jenkins S, Draper H (2015) Care, monitoring, and companionship: views on care robots from older people and their carers. Int J Soc Robot 7:673–683. https://doi.org/10.1007/s12369-015-0322-y
21. Feil-Seifer BD, Matari MJ (2011) Socially assistive robotics. Ethical issues related to technology. Robot Autom Mag 18:24–31. https://doi.org/10.1109/MRA.2010.940150
22. Matsuzaki H, Lindemann G (2016) The autonomy-safety-paradox of service robotics in Europe and Japan: a comparative analysis. AI Soc 31:501–517. https://doi.org/10.1007/s00146-015-0630-7
23. Lipp B (2022) Caring for robots: how care comes to matter in human-machine interfacing. Soc Stud Sci 030631272210814. https://doi.org/10.1177/03063127221081446
24. Styler BK, Wang E, Ding D (2025) Qualitative perspectives from Kinova® Jaco® robotic arm owners: understanding daily device usage. Disabil Rehabil 1–12
25. Vallès-Peris N, Domènech (2023) Caring in the in-between: a proposal to introduce responsible AI and robotics to healthcare. AI Soc 38:1685–1695. https://doi.org/10.1007/s00146-021-01330-w
26. Catchpole K, Bisantz A, Hallbeck MS et al. (2019) Human factors in robotic assisted surgery: lessons from studies ‘in the wild’. Appl Ergon 78:270–276. https://doi.org/10.1016/j.apergo.2018.02.011
27. Miki T, Lee J, Hwangbo J et al. (2022) Learning robust perceptive locomotion for quadrupedal robots in the wild. Sci Robot 7. https://doi.org/10.1126/scirobotics.abk2822
28. Zhou X, Wen X, Wang Z et al. (2022) Swarm of micro flying robots in the wild. Sci Robot 7:1–17. https://doi.org/10.1126/scirobotics.abm5954
29. Felt U (2018) Responsible research and innovation. Routledge Handb Genomics Health Soc 108–116. https://doi.org/10.4324/9781315451695
30. Bijker WE (2009) How is technology made?-that is the question! Camb J Econ 34:63–76. https://doi.org/10.1093/cje/bep068
31. Latour B (1999) La esperanza de Pandora: ensayos sobre la realidad de los estudios de la ciencia. Gedisa, Barcelona
32. Nickelsen NCM, Simonsen Abildgaard J (2022) The entwinement of policy, design and care scripts: providing alternative choice-dependency situations with care robots. Sociol Health Illn 44:451–468. https://doi.org/10.1111/1467-9566.13434
33. Vallès-Peris N, Barat-Auleda O, Domènech M (2021) Robots in healthcare? What patients say. Int J Environ Res Public Health 18:9933. https://doi.org/10.3390/ijerph18189933
34. Van Wynsberghe A (2015) Healthcare robots. Ethics, design and implementation. Routledge, London and New York
35. Hammersley M (2018) What is ethnography? Can it survive? Should it? Ethnogr Educ 13:1–17. https://doi.org/10.1080/17457823.2017.1298458
36. Knoblauch H (2005) Focused ethnography. Forum Qual Sozialforschung 6
37. Willis P, Trondman M (2002) Manifesto for ethnography. Cult Stud Crit Methodol 2:394–402
38. Pellegrino ED (1990) The relationship of autonomy and integrity in medical Ethics. Bull Pan Am Health Organ PAHOlletin PAHO 24:361–371
39. a VM (2001) The care perspective and autonomy. Med Health Care Philos 4:289–294. https://doi.org/10.1023/A:1012048907443
40. Oshana M (2020) Relational autonomy. In: LaFollette H (ed) The International encyclopedia of ethics, 1st edn. Wiley, pp 1–13
41. Floridi L, Cowls J (2019) A unified framework of Five Principles for AI in society. Harv Data Sci Rev 1–15. https://doi.org/10.1162/99608f92.8cd550d1
42. Formosa P (2021) Robot autonomy vs. Human autonomy: social robots, artificial intelligence (AI), and the nature of autonomy. Minds Mach 31:595–616. https://doi.org/10.1007/s11023-021-09579-2
43. Darwall S (2006) The value of autonomy and autonomy of the will. Ethics 116:263–284
44. Etzioni A, Etzioni O (2016) AI assisted ethics. Ethics Inf Technol 18:149–156. https://doi.org/10.1007/s10676-016-9400-6
45. Michael M (2003) Between the mundane and the exotic: time for a different sociotechnical stuff. Time Soc 12:127–143. https://doi.org/10.1177/0961463X03012001372
46. Verkerk M (1999) A care perspective on coercion and autonomy. Bioethics 13:358–368. https://doi.org/10.1111/1467-8519.00163
47. Tronto JC (1993) Moral boundaries. A political argument for an ethic of care. Routledge, New York City
48. Donchin A (2001) Understanding autonomy relationally: toward a Recon®guration of bioethical Principles. J Med Philos 26. https://doi.org/10.1076/jmep.26.4.365.3012
49. Mackenzie C (2019) Feminist innovation in philosophy: relational autonomy and social justice. Womens Stud Int Forum 72:144–151. https://doi.org/10.1016/j.wsif.2018.05.003
50. Scully JL (2023) Feminist Bioethics. In: Stanf Encycl Philos
51. Vallès-Peris N, Domènech M (2023) Care robots for the common good: ethics as politics. Humanit Soc Sci Commun 10:345. https://doi.org/10.1057/s41599-023-01850-4
52. Soma R, Bratteteig T, Saplacan D et al. (2020) Strengthening human autonomy. In the era of autonomous technology. Scand J Inf Syst 34:1–3. https://doi.org/10.1145/3419249.3420097
53. Law J (1994) Organizing modernity. Blackwell, Oxford, UK & Cambridge, USA
54. Hui Y (2015) Towards a relational materialism: a reflection on language, relations and the digital. Digit Cult Soc 1:131–148. https://doi.org/10.14361/dcs-2015-0109
55. Barad K (2003) Posthumanist performativity: toward an understanding of how matter comes to matter. J Women Cult Soc 28:801–831
56. Levinas E (1998) La huella del otro. Taurus, México
57. Nossaman LE, Nossaman BD (2022) Hawthorne effect: more than just telephones. Ochsner J 22:286–289. https://doi.org/10.31486/toj.22.5031
58. McCambridge J, Witton J, Elbourne DR (2014) Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects. J Clin Epidemiol 67:267–277. https://doi.org/10.1016/j.jclinepi.2013.08.015
59. Wickstrom G, Bendix T (2000) The "Hawthorne effect" - what did the original Hawthorne studies actually show? Scand J Work Environ Health 26:363–367. https://doi.org/10.5271/sjweh.555
60. Maroto-Gómez M, Alonso-Martín F, Malfaz M et al. (2023) A Systematic literature review of decision-making and control systems for autonomous and social robots. Int J Soc Robot 15:745–789. https://doi.org/10.1007/s12369-023-00977-3
61. Bhattacharjee T, Gordon EK, Scalise R et al. (2020) Is more autonomy always better?: exploring preferences of users with mobility impairments in robot-assisted feeding. In Proceedings of

the 2020 ACM/IEEE International Conference on Human-Robot Interaction. ACM, Cambridge United Kingdom, pp 181–190

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Nuria Vallès-Peris is sociologist, Tenured Scientist at the Artificial Intelligence Research Institute at the Spanish National Resarch Council (IIIA-CSIC) and researcher at the Barcelona Science and Technology Studies Group (STS-b) at the Universitat Autònoma de Barcelona. Her work lies at the intersection of social robotics and science and technology studies (STS), focusing on the social, ethical, and political dimensions of social robotics. She examines how care robots and emerging technologies reshape practices of care, health, and social inclusion in contemporary societies. Her research adopts interdisciplinary and participatory approaches, combining qualitative methods with responsible innovation frameworks, and addresses co-creation, digital inequalities, and the democratic governance of robotics.

Cristian Barrué is a researcher at the Institut de Robòtica i Informàtica Industrial (CSIC-UPC). His work lies at the intersection of robotics, artificial intelligence and assistive technologies, with a focus on intelligent systems that can be deployed in real-world care environments. He develops computational models for perception and decision support, leveraging machine learning and sensor data to improve safety, autonomy and user experience in unstructured settings. His research contributes to assistive and service robotics applications for health and ageing, combining user-centred design with responsible and ethically grounded development and evaluation. He participates in national and European research projects and collaborates with interdisciplinary teams addressing the technical and societal challenges of technology-enabled support for ageing societies.

Guillem Alenyà is a researcher and director of Institut de Robòtica i Informàtica Industrial CSIC-UPC. His research focus on cognitive robotics, robot learning, and human–robot interaction, with emphasis on perception-driven manipulation and adaptive behaviors. He investigates how robots can acquire robust skills through learning and interaction in dynamic environments. His work integrates computer vision, artificial intelligence, and control architectures to advance service and assistive robotics. He has contributed to numerous competitive research projects and publishes in leading international journals and conferences in robotics and intelligent systems.