SESSION 10

# OMICS and AI in PEDIATRICS

## AI DRIVEN DISTRACTION TECHNIQUES IN PEDIATRIC PATIENTS


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# CHILDHOOD CANCER AND MENTAL HEALTH

***1-2% of neoplasms*. It differs from adult cancers in terms of affected organ, etiology, drug responsiveness and prognosis.** Approximately **300,000 children** new diagnosis every year in the world.

## Potential MENTAL HEALTH DISORDERS:

- Depression
- Anxiety
- Post-traumatic stress
- Suicidal Ideation

(Bitsko et al., 2016)

***Survivors:*** patients with **complex problems** and **late effects** induced by disease and treatment, surgery, **radiotherapy** and chemotherapy**.**

| Risk Factors | Highest Risk Factors |
|---|---|
| **Host Factors**<br>Female sex<br>Family history of depression, anxiety, or mental illness<br>**Social Factors**<br>Lower household income<br>Lower educational achievement<br>**Treatment Factors**<br>Hematopoietic Cell Transplant<br>**Medical Conditions**<br>Chronic pain | **Host Factors**<br>CNS tumor<br>CNS-directed therapy<br>Premorbid learning or emotional difficulties<br>Perceived poor physical health<br>**Social Factors**<br>Failure to graduate from high school |

# DISTRACTION

Non-pharmacological interventions (NPI) or non-pharmacological therapies (NPT) are defined as any **non-chemical intervention**, which is theoretically supported, targeted and replicable, performed on a patient or caregiver and potentially capable of obtaining a relevant benefit.

The Paediatric Pain document (2010) of the Italian Ministry of Health recognizes DISTRACTION as a cognitive-behavioural non-pharmacological analgesic therapy.

The adoption of **NPI as it will contribute to better health, more life enjoyment and reduce, health costs.** The ideal place to recommend NPI, as a preventive and/or curative measure is Primary Health Care [1,2].

1. World Health Organization (WHO). International Conference on Primary Health Care. Series "Health for all" n° 1. Geneva, Switzerland, 1978 ISBN: 92 4 354135 8
2. World Health Organization (WHO). Global Conference on Primary Health Care. Astana, Kazakhstan, October 2018. https://www.who.int/primary-health/conference-phc

# CATEGORIES

- **Passive distraction** calls for the child to remain quiet while the dental health care professional is actively distracting him. It includes watching videos, listening to music on headphones, reading a book to the child, or telling him a story.
- **Active distraction** encourages the child's participation in the activities during the procedures. Active techniques include singing songs, squeeze balls, relaxation breathing, and playing with electronic devices.

# PLAY, PLAYTHERAPY


# NAO IN ITALY. AN EMERGING PHENOMENON



Un robot in pediatria

**FOTOGALLERIA** La robot-terapia sta diventando sempre più diffusa negli ospedali e nei reparti pediatrici italiani

*di Marco Pinna fotografie di Martina Cirese*

« PRECEDENTE Foto 8 di 10 SUCCESSIVO »

In Italy there are many centers that adopted Nao robotic for different purposes, from autism to psychological interventions for diabetic patients.

Nowdays there are 8 Nao centres in Italy.

# ROBOTICS IN DIFFERENT SETTING

## EDUCATION

Patient Education and Counseling

Volume 92, Issue 2, August 2013, Pages 174–181

Using a robot to personalise health education for children with diabetes type 1: A pilot study

Olivier A. Blanson Henkemans[a], Bert P.B. Bierman[a], Joris Janssen[a], Mark A. Neerincx[a], Rosemarijn Looije[a], Hanneke van der Bosch[b], Jeanine A.M. van der Giessen[b]

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https://doi.org/10.1016/j.pec.2013.04.012 Get rights and content

## MOVEMENT

**A Dancing Robot for Rhythmic Social Interaction**

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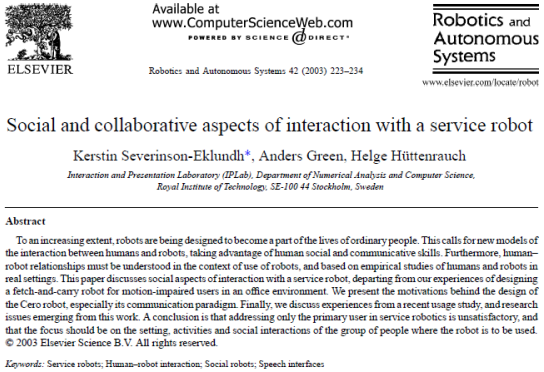
**ABSTRACT**

This paper describes a robotic system that uses dance as a form of social interaction to explore the properties and importance of rhythmic movement in general social interaction. The system consists of a small creature-like robot whose movement is controlled by a rhythm-based software system. Environmental rhythms can be extracted from auditory or visual sensory stimuli, and the robot synchronizes its movement to a dominant rhythm. The system was demonstrated, and an exploratory study conducted, with children interacting with the robot in a generalized dance task. Through a behavioral analysis of videotaped interactions, we found that the robot's synchronization with the background music had an effect on children's interactive involvement with the

## COLLABORATION



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Robotics and Autonomous Systems

Robotics and Autonomous Systems 42 (2003) 223–234

www.elsevier.com/locate/robot

Social and collaborative aspects of interaction with a service robot

Kerstin Severinson-Eklundh*, Anders Green, Helge Hüttenrauch

*Interaction and Presentation Laboratory (IPLab), Department of Numerical Analysis and Computer Science, Royal Institute of Technology, SE-100 44 Stockholm, Sweden*

**Abstract**

To an increasing extent, robots are being designed to become a part of the lives of ordinary people. This calls for new models of the interaction between humans and robots, taking advantage of human social and communicative skills. Furthermore, human–robot relationships must be understood in the context of use of robots, and based on empirical studies of humans and robots in real settings. This paper discusses social aspects of interaction with a service robot, departing from our experiences of designing a fetch-and-carry robot for motion-impaired users in an office environment. We present the motivations behind the design of the Cero robot, especially its communication paradigm. Finally, we discuss experiences from a recent usage study, and research issues emerging from this work. A conclusion is that addressing only the primary user in service robotics is unsatisfactory, and that the focus should be on the setting, activities and social interactions of the group of people where the robot is to be used.



*Keywords:* Service robots; Human-robot interaction; Social robots; Speech interfaces

## SOCIAL INTERACTION

*Vous consultez*

**Encouraging social interaction skills in children with autism playing with robots**

A case study evaluation of triadic interactions involving children with autism, other people (peers and adults) and a robotic toy

*par* **Ben Robins**

*et* **Kerstin Dautenhahn**

Adaptive Systems Research Group, School of Computer Science, University of Hertfordshire,UK. E-mail: b.robins,k.dautenhahn@herts.ac.uk.

Universal Access in the Information Society

December 2005, Volume 4, Issue 2, pp 105–120

Robotic assistants in therapy and education of children with autism: can a small humanoid robot help encourage social interaction skills?

# WHAT ABOUT ROBOTICS IN PEDIATRIC ONCOLOGY?

Child oriented storytelling with NAO robot in hospital environment: preliminary application results

Leire Ozaeta*, Manuel Graña*, Maya Dimitrova**, Alexander Krastev**

*Computational Intelligence Group, Dept. CCIA, University of the Basque Country, Spain

**Institute of Robotics - BAS

Proceedings of the Twenty-Sixth International Florida Artificial Intelligence Research Society Conference

**Robots Learn to Play: Robots Emerging Role in Pediatric Therapy**

**Ayanna M. Howard**
School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA
ayanna.howard@ece.gatech.edu

**STRATEGIC WORKSHOP**

DSPF, project RONNI, 07_ECVII_PA07
"INCREASING THE WELL BEING OF THE POPULATION BY R&ICT BASED INNOVATIVE EDUCATION"

Venue: Hotel Orphey, Bansko, Bulgaria, https://orphey.com/

# DETERMINATION OF REQUIREMENTS


**Explicit characteristics of humanoid robot**

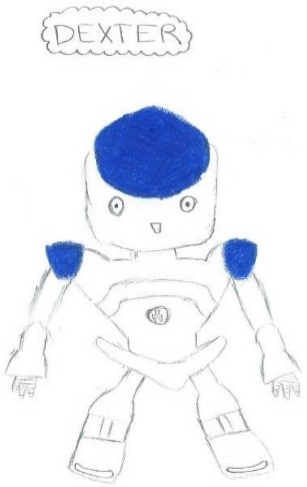
slow
small
repetive
predictable
not competitive
connected to a digital personal living assistant

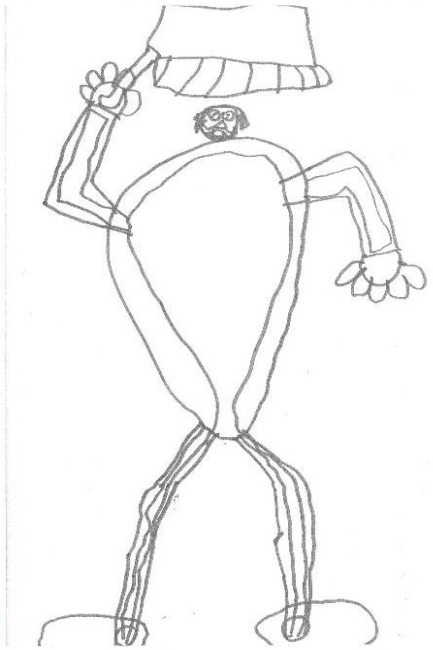
**Empathy**
**Fondness**
**Familiarity**
**Safety**

Indirect approach

Attribution of meaning

# IMAGINARY ROBOTS



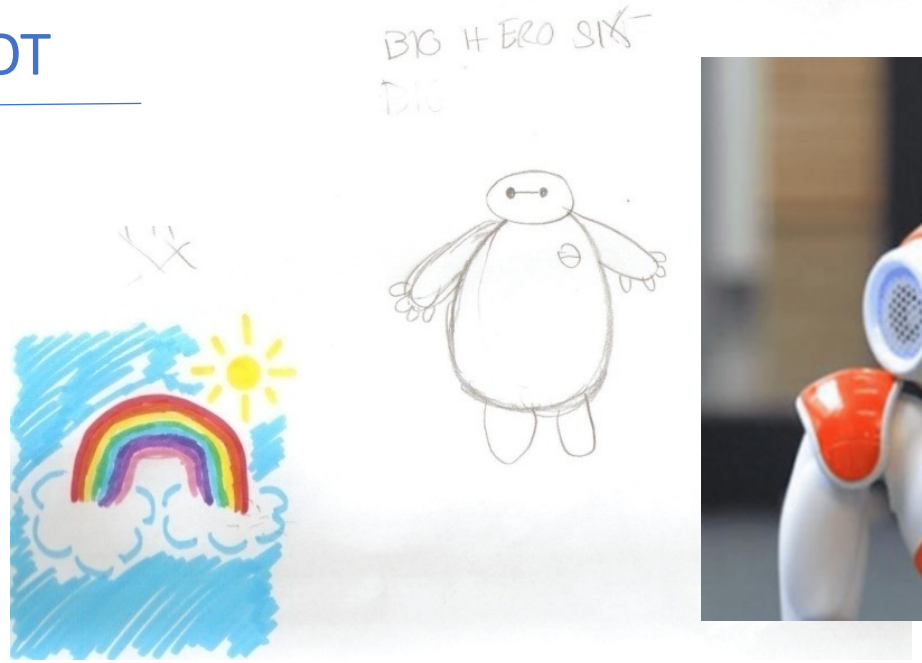



We asked the children to meet him and to look at its abilities (he can dance, walk, play, make questions)

At first they started to draw NAO Marino. The children's robot images were deeply influenced, so some children drew robots which belong to tv series.

On the contrary, for many children it was the occasion to represent themselves for the first time, taking NAO like an example, not competitive, to imitate

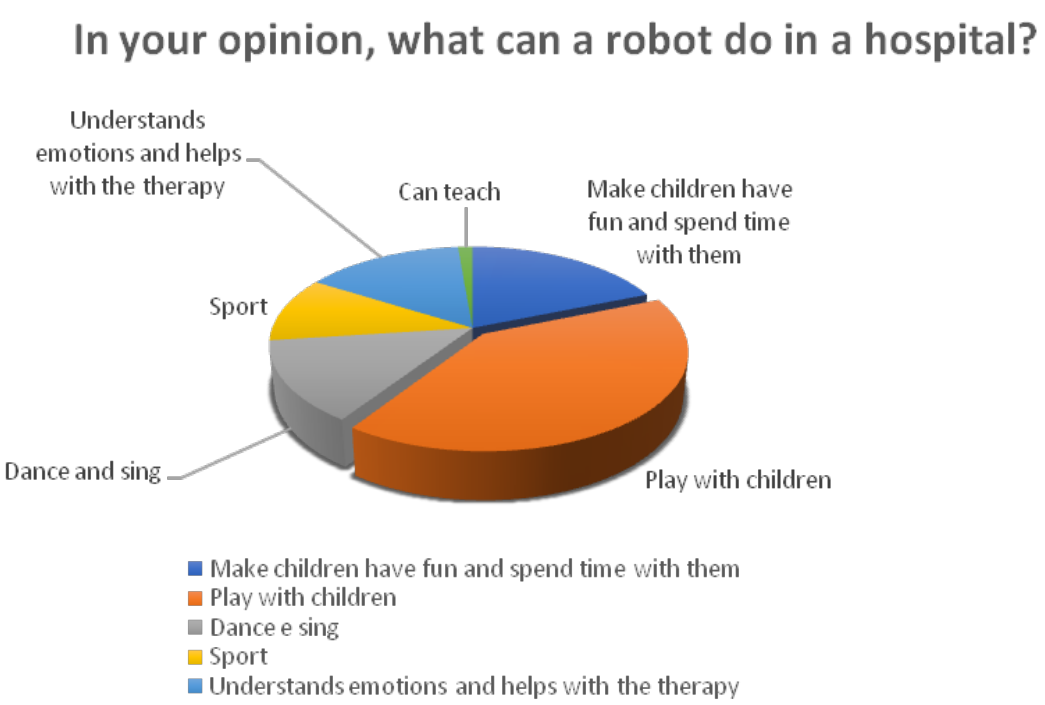
# A REAL ROBOT

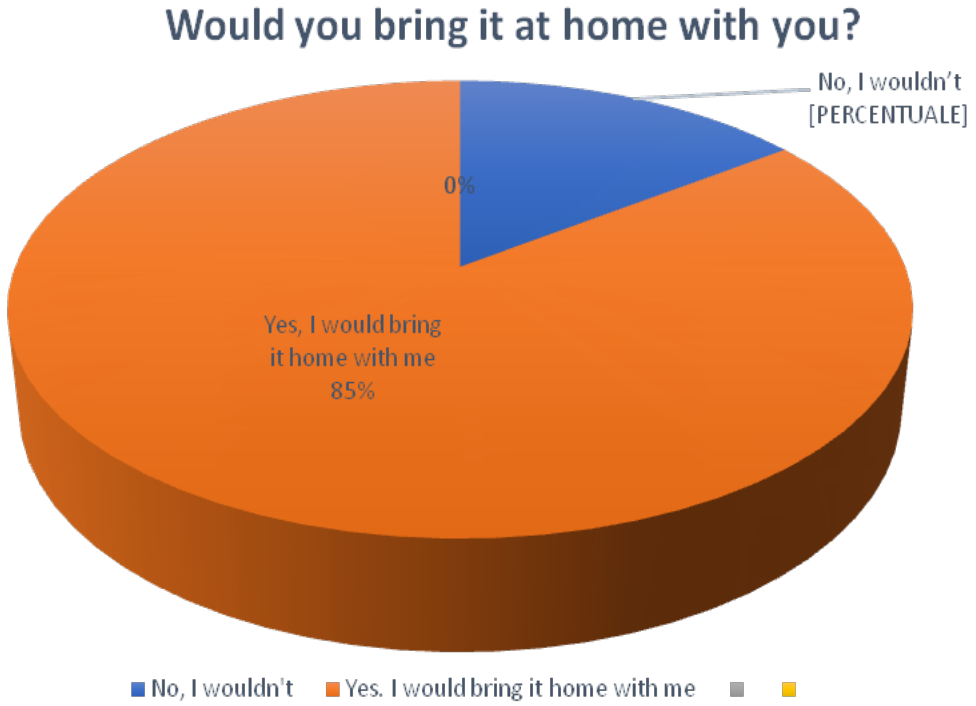



The children asked to meet him again, to touch him and to play with him

# “A ROBOT IN THE HOSPITAL”, SUBMITTED QUESTIONNAIRE IN PAEDIATRICS

## How can we make use of a robot in the hospital?
## Would you bring it at home with you?



# MARINO'S PROJECT – AT UNIBO IRCCS SANT'ORSOLA HOSPITAL

Nao Marino's project started in 2017 thanks to Golinelli's association that gave the Nao robot to Sant'Orsola's General Hospital .

The study was approved by the ethics committee

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

IRCCS S.Orsola

SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA

# METHODS

Thanks to the feeling, perhaps children could tell NAO something else about them.

We exposure children to the robot to stimulate the **identification of different emotions**. Each person is exposed to the simulation of the 4 main emotions: **ANGER, FEAR, SADNESS, HAPPINESS.**

We observe how many attempts the subject needs to identify the emotion.

The session is completed with the Nao dancing and *entertaining* the child for a few minutes.

The project plan provides **2 groups** of study and **1 of control study**:

The first group is composed of oncological patients.

The second group is composed of non-oncological chronic patients.

The control group is composed of patients' sisters and brothers.

After 6 months a re-test is done.

# SAMPLES AND GROUPS - O.U. Pediatria Pession

- 17 oncological pediatric patients

→ 9 of them were wrong about at least one emotion

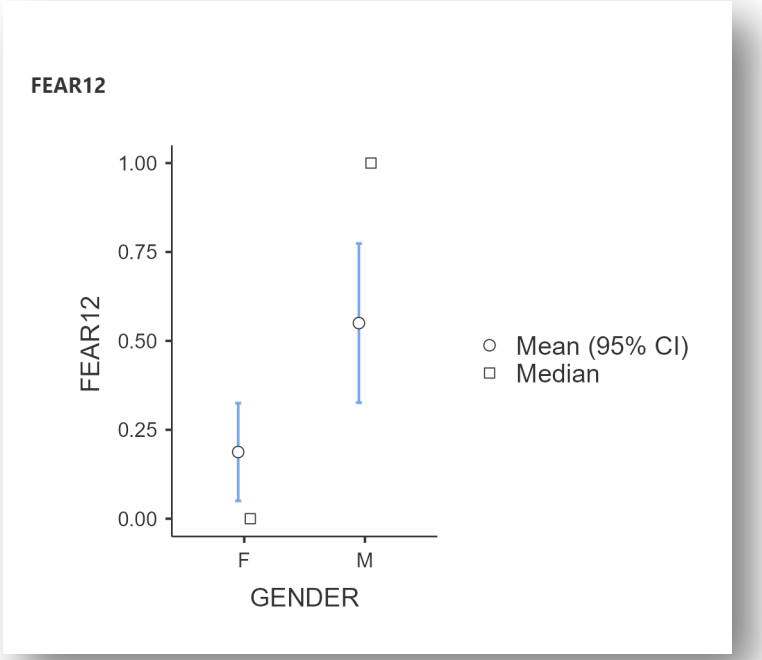
- 19 pediatric chronic patients (non oncological)

→ 6 of them were wrong about at least one emotion

- 12 patients' brothers/sisters

→ 5 of them were wrong about at least one emotion

# RESULTS




- No differences between groups (oncological/cronic/siblings)
- No differences between ages
- Gender differences: males recognise less FEAR ($p<.01$)

R. Rondelli IRCCS S.Orsola

# NAO AND RESEARCH

Our application has highlighted that Nao Robot, thanks its characteristics :

1. can be used to distract children in hospital by providing motivation and joy

2. is able to stay with the patients during the different step of their experience and to make usual daily tasks more exciting

3. encourages the expression of feeling

4. brings out the difficulty to recognize the emotions like fear

# AI DRIVEN DISTRACTION TECHNIQUES IN PEDIATRIC PATIENTS

## OPPORTUNITIES IN RADIOTHERAPY

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# EVIDENCES

Pediatric Radiology (2019) 49:1384–1390
https://doi.org/10.1007/s00247-019-04360-1

PEDIATRIC ONCOLOGIC IMAGING

## Artificial intelligence applications for pediatric oncology imaging

Heike Daldrup-Link[1,2]

Received: 1 December 2018 / Revised: 21 December 2018 / Accepted: 14 February 2019 / Published online: 26 September 2019


PERSONALIZE AND PREDICT



ARTIFICIAL INTELLIGENCE

review article

## Applications of Artificial Intelligence in Pediatric Oncology: A Systematic Review

Siddhi Ramesh, BA[1]; Sukarn Chokkara, BA[1]; Timothy Shen, BA[1]; Ajay Major, MD, MBA[2]; Samuel L. Volchenboum, MD, PhD[3]; Anoop Mayampurath, PhD[3]; and Mark A. Applebaum, MD[3]

JCO® Clinical Cancer Informatics
An American Society of Clinical Oncology Journal

IMPROVING DIAGNOSTICS, DECISION MAKING, AND MONITORING

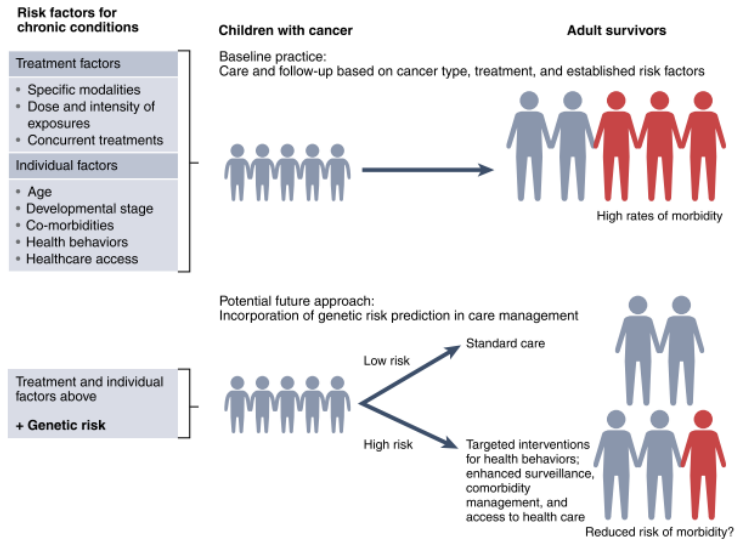



**Fig. 1 | Conceptualizing the risk of significant morbidity among survivors of childhood cancer.** Survivors of childhood cancer are at increased risk for morbidity in adulthood. An emerging approach to care could include incorporating genetic risk into comprehensive risk prediction.

nature medicine

CANCER

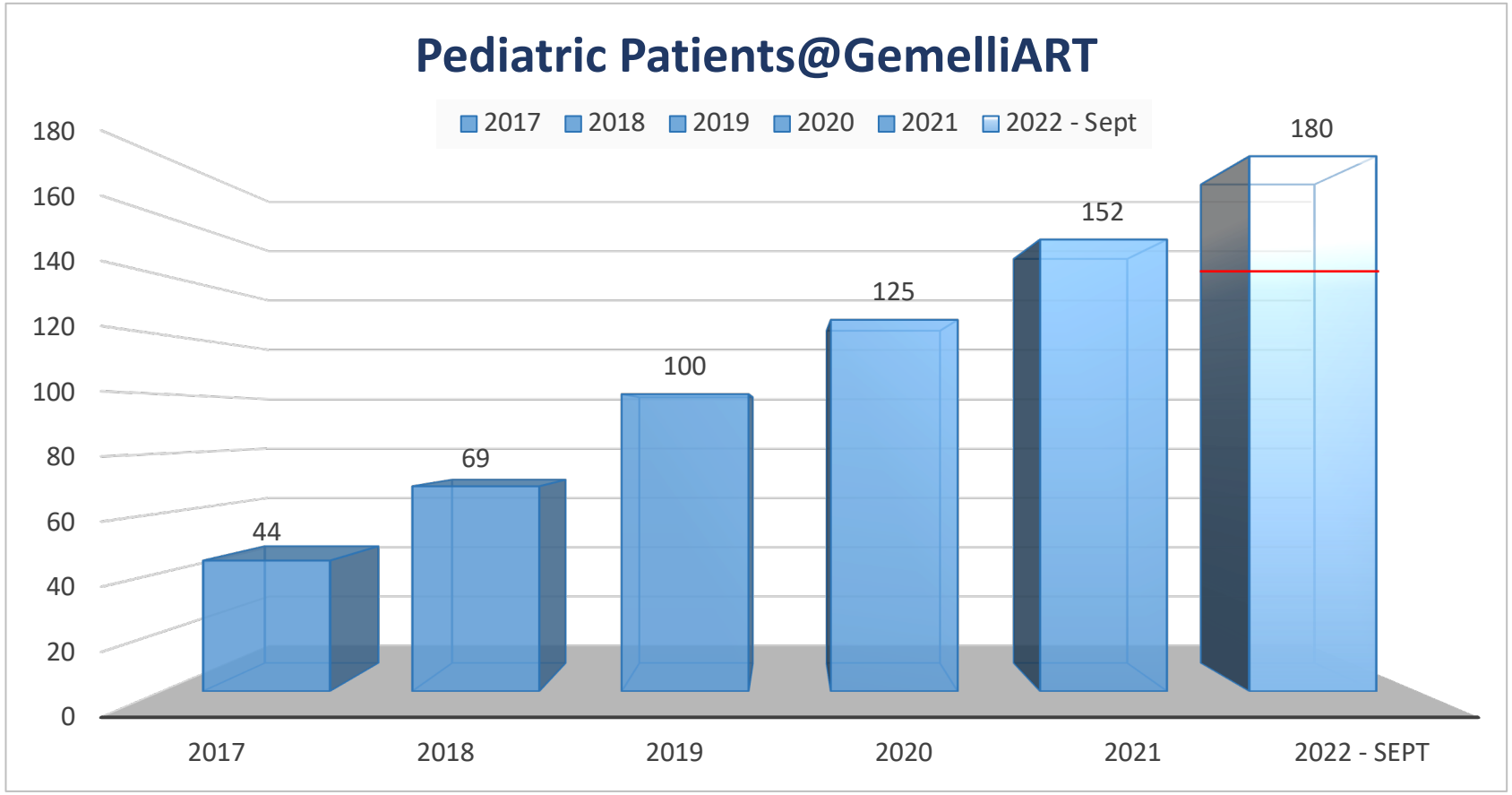
## Predicting chronic morbidity in childhood cancer survivors

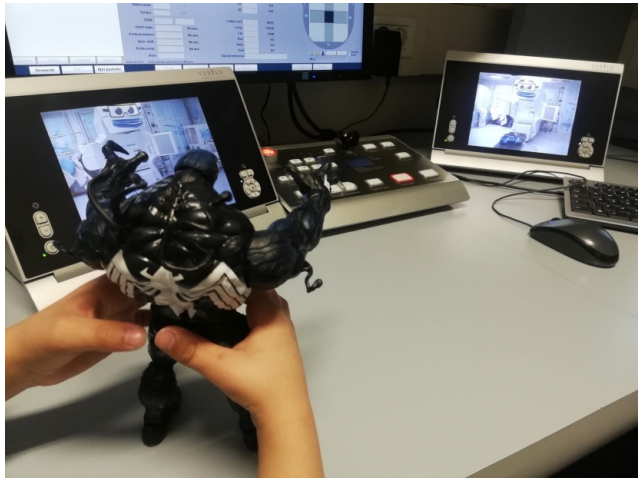
Incorporating genetic factors into risk models improves the prediction of severe obesity for survivors of childhood cancer, which could promote early interventions and better long-term care.

Lynda M. Vrooman and Lisa R. Diller

RISK PREVENTION

# GEMELLI ART RADIOTHERAPY



# PEDIATRIC RADIOTHERAPY

- *P*
- *M*
- *p*
- *(*
- *(*
- *(*

Neuropsychopharmacology
At the intersection of brain, behavior, and therapeutics

"Allostatic load" refers to the price the body pays for being forced to adapt to **adverse psychosocial or physical situations**, and it represents either the presence of too much stress or the inefficient operation of the stress hormone response system, which must be turned on and then turned off again after the stressful situation is over. (McEwen B.S.,2000)

Article

**Allostatic Load in Cancer: A Systematic Review and Mini Meta-Analysis**

Biological Research for Nursing
2021, Vol. 23(3) 341-361
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Asha Mathew, MBA, MSN, BSN, RN, RM[1,2], Ardith Z. Doorenbos, PhD, RN, FAAN[1,3], Hongjin Li, PhD, RN[1,3], Min Kyeong Jang, PhD, RN, KOAPN[1,3], Chang Gi Park, PhD[1,4], and Ulf G. Bronas, PhD, ATC, FSVM, FAHA[1,5]

frontiers in Behavioral Neuroscience

ORIGINAL RESEARCH

**From Allostatic Load to Allostatic State—An Endogenous Sympathetic Strategy to Deal With Chronic Anxiety and Stress?**

Enrico Ullmann[1,2,3*], Seth W. Perry[4], Julio Licinio[4], Ma-Li Wong[4], Eliyahu Dremencov[5,6,4], Evgenii L. Zavjalov[7], Oleg B. Shevelev[7], Nikita V. Khotskin[7], Galina V. Koncevaya[7], Anna S. Khotshkina[7], Mikhail P. Moshkin[7], Maxim S. Lapshin[3], Maria V. Komelkova[3], Inna V. Feklicheva[3], Olga B. Tseilikman[3], Olga P. Cherkasova[8], Kamaldeep S. Bhui[9], Edgar Jones[10], Clemens Kirschbaum[11], Stefan R. Bornstein[1,12] and Vadim Tseilikman[3]

Neuroscience and Biobehavioral Reviews 136 (2022) 104605

Contents lists available at ScienceDirect

Neuroscience and Biobehavioral Reviews

journal homepage: www.elsevier.com/locate/neubiorev

ELSEVIER

**Adverse childhood experiences and allostatic load: A systematic review**

Sabine Finlay[a,b,c,*], Cody Roth[a,b,c], Tiansha Zimsen[d], Tahnee Lee Bridson[e,f], Zoltan Sarnyai[a,b,c,1], Brett McDermott[d,1]

[a] Laboratory of Psychiatric Neuroscience, Centre for Molecular Therapeutics, James Cook University, Townsville, Queensland, Australia
[b] Australian Institute of Tropical Health and Medicine, James Cook University, Townsville, Queensland, Australia
[c] College of Public Health, Medical & Veterinary Sciences, James Cook University, Queensland, Australia
[d] College of Medicine and Dentistry, James Cook University, Townsville, Queensland, Australia
[e] North-West Mental Health, The Royal Melbourne Hospital, Victoria, Australia
[f] Fireside Research, Woodbridge Tasmania, Australia

# DISTRACTION IN RADIOTHERAPY

## HOW?

**DISTRACTION STIMULI**

**OUTSIDE RT ROOM**


**Objective:** compliance, therapeutic alliance, involvement, understanding, expression, interaction…

→ ACTIVE DISTRACTION

**INSIDE RT ROOM**

**Objectives:** trust, calmness, relaxation, safety, quiet, holding of position…

→ PASSIVE DISTRACTION

# AI AND NAO IN RADIOTHERAPY

## WHY?

**THE DREAMS CHEST PROJECT EXPERIENCE: TOKEN ECONOMY FOR INCREASING COMPLIANCE IN PEDIATRIC RADIOTHERAPY**

SIOP 2022

Elisa Marconi[1,2], Francesco Beghella Bartoli[2], Elisa Meldolesi[2], Giulia Panza[2], Loredana Dinapoli[1,2], Annalisa Serra[3], Giuseppe Maria Milano[3], Angela Mastronuzzi[3], Antonio Ruggiero[4,5], Daniela Pia Rosaria Chieffo[1,5], Maria Antonietta Gambacorta[2,5], Vincenzo Valentini[2,5], Mario Balducci[2,5], Silvia Chiesa[2]

[1]UOS di Psicologia Clinica, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy
[2]UOC di Radioterapia Oncologica, Dipartimento Diagnostica per Immagini, Radioterapia Oncologica ed Ematologia, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy
[3]Dipartimento Oncoematologia, Terapia Cellulare, Terapie Geniche e Trapianto Emopoietico, Ospedale Pediatrico Bambino Gesù IRCSS, Rome, Italy
[4]UOC di Oncologia Pediatrica, Dipartimento della Salute della Donna, del Bambino e di Sanità Pubblica, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy
[5]Università Cattolica del Sacro Cuore, Rome, Italy

6% reduction in sedation corresponds to an average savings of more than € 45,000 in 2021

HOW SATISFIED ARE YOU WITH

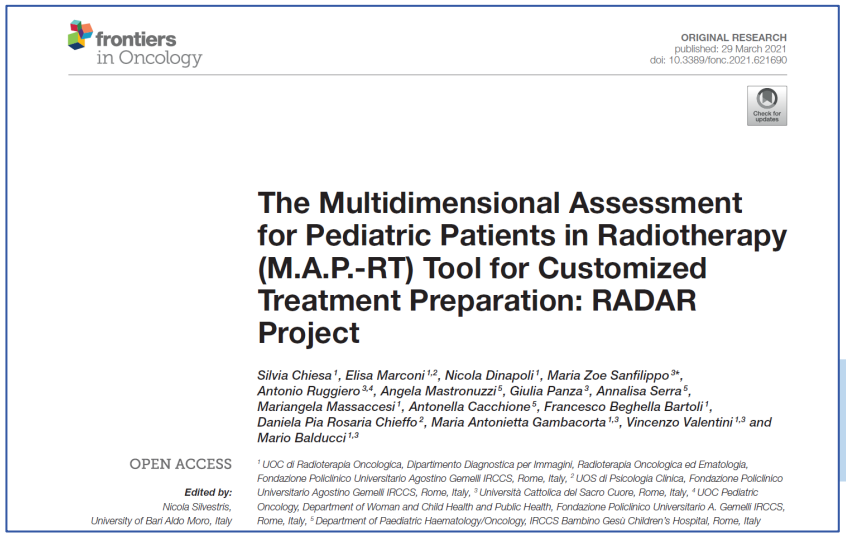
| GENERAL SATISFACTION | Very Dissatisfied | Dissatisfied | Neither satisfied or dissatisfied | Satisfied | Very Satisfied |
|---|---|---|---|---|---|
| 1. The overall care your child is receving | 1 | 2 | 3 | 4 | 5 |
| 2. How friendly and helpulf the staff is | 1 | 2 | 3 | 4 | 5 |
| 3. The way your child is treated at the hospital | 1 | 2 | 3 | 4 | 5 |

Mean score:
**General Satisfaction = 94**
**Information = 85**
**Inclusion of Family = 87**
**Communication = 88**
**Technical Skills = 88**
**Emotional Needs = 90**

**PILOT STUDY OF THE ITALIAN VERSION OF THE PEDSQL™ HEALTHCARE SATISFACTION HEMATOLOGY/ONCOLOGY MODULE WITH PARENTS OF CHILDREN UNDERGOING RADIOTHERAPY.**

***-submitted***

# PERSPECTIVE



frontiers in Oncology

ORIGINAL RESEARCH
published: 29 March 2021
doi: 10.3389/fonc.2021.621690

**The Multidimensional Assessment for Pediatric Patients in Radiotherapy (M.A.P.-RT) Tool for Customized Treatment Preparation: RADAR Project**

*Silvia Chiesa[1], Elisa Marconi[1,2], Nicola Dinapoli[1], Maria Zoe Sanfilippo[3]*, Antonio Ruggiero[3,4], Angela Mastronuzzi[5], Giulia Panza[3], Annalisa Serra[5], Mariangela Massaccesi[1], Antonella Cacchione[5], Francesco Beghella Bartoli[1], Daniela Pia Rosaria Chieffo[2], Maria Antonietta Gambacorta[1,3], Vincenzo Valentini[1,3] and Mario Balducci[1,3]*

OPEN ACCESS

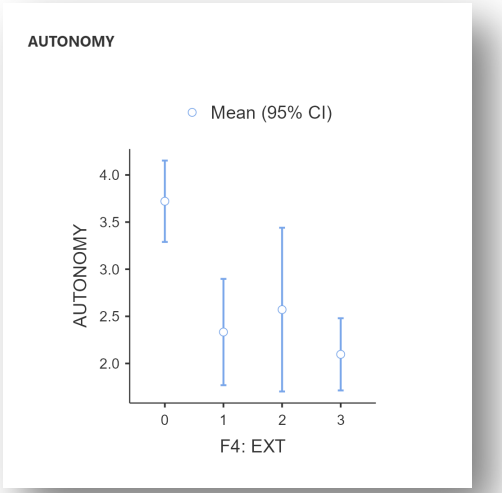
*Edited by:*
Nicola Silvestris,
University of Bari Aldo Moro, Italy

[1] UOC di Radioterapia Oncologica, Dipartimento Diagnostica per Immagini, Radioterapia Oncologica ed Ematologia, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy, [2] UOS di Psicologia Clinica, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy, [3] Università Cattolica del Sacro Cuore, Rome, Italy, [4] UOC Pediatric Oncology, Department of Woman and Child Health and Public Health, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy, [5] Department of Paediatric Haematology/Oncology, IRCCS Bambino Gesù Children's Hospital, Rome, Italy

EXAMPLE: 1/28 items

*About emotion/distress expression*

***F4: Patient externalizing problems***




***Externalizing***
*****p<.001***

*AUTONOMY outcome is calculated as the quotient of the number of fractions divided by the number of psychological interventions during RT*

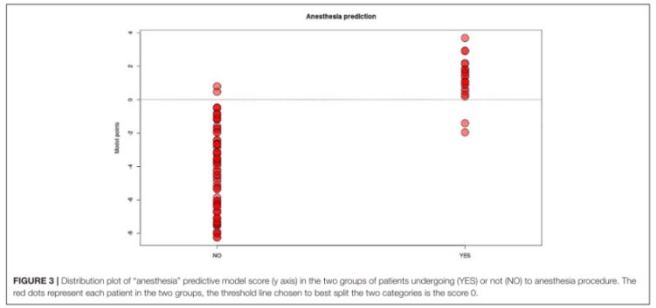



**FIGURE 3 |** Distribution plot of "anesthesia" predictive model score (y axis) in the two groups of patients undergoing (YES) or not (NO) to anesthesia procedure. The red dots represent each patient in the two groups, the threshold line chosen to best split the two categories is the score 0.

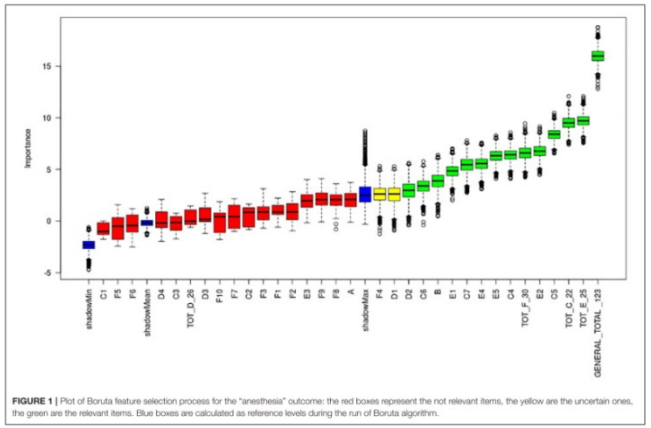



**FIGURE 1 |** Plot of Boruta feature selection process for the "anesthesia" outcome: the red boxes represent the not relevant items, the yellow are the uncertain ones, the green are the relevant items. Blue boxes are calculated as reference levels during the run of Boruta algorithm.

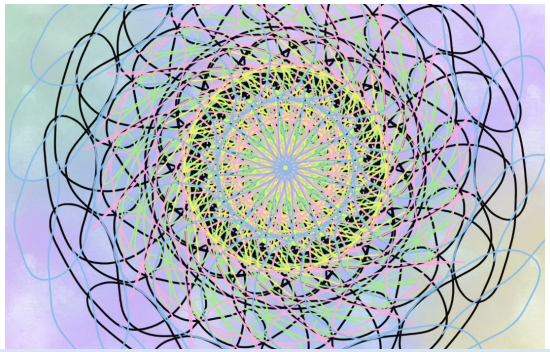
# CONCLUSIONS

CAN A **ROBOT** HELP PEDIATRIC RADIOTHERAPY?

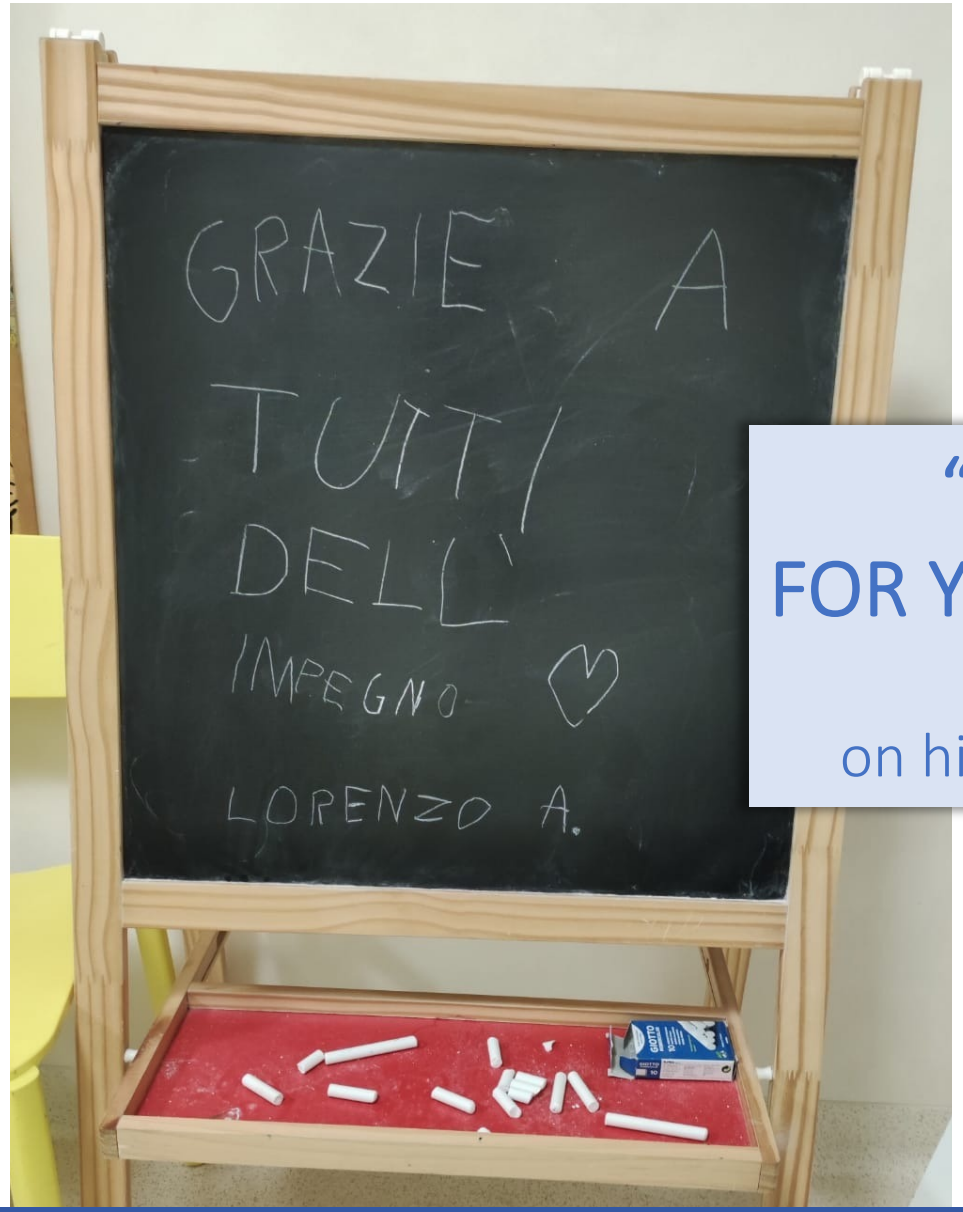
- *It can be **AI-driven**, according to assessment, needs and environments*
- ***It can stay with them** during treatment*
- *It could be used with **daily psychological monitoring** and parent satisfaction report*







INTERACTIONS - COURAGE - SAFETY - FRIENDSHIP - PRESENCE - FUN - SPECIAL - CONTROL - ART - EMOTION - IMAGINATION




"THANK YOU ALL
FOR YOUR COMMITMENT"

Lorenzo, 7 years-old,
on his last day of Radiotherapy

# ROBOT IN HOSPITAL

ITALY

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