

Seal Robot, PARO as Neurological Therapeutic Medical Device for Dementia Patients



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Therapeutic Seal Robot: PARO



Contents



- z Seal Robot, PARO
- z Robot Therapy
- z Results of Clinical Tests
- z PARO in Disaster Areas in Japan

Animal Assisted Therapy/Activity

- z **Psychological Merits**

- y **Cheer**

- y **Motivation**

- z **Physiological Merits**

- y **Stress Reduction**

- y **Rehabilitation**

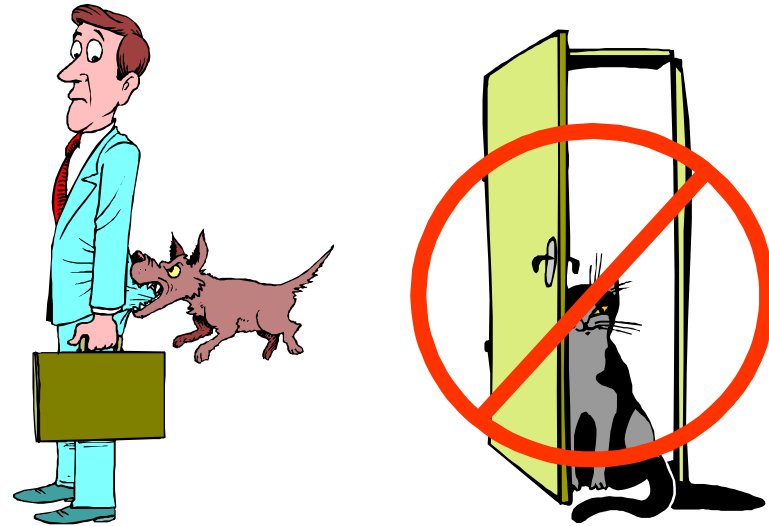
- z **Social Merits**

- y **Encourage Communication**



Problems of Owning Animals

- z Allergies
- z Bites
- z Infection
- z House regulation



Difficult to introduce!

Therapeutic Robot Paro



Model: Baby of Harp Seal



Seal Robot, Paro, for Therapy 8th Generation

CPU

32bit RISC

Voice Recognition
Learning Functions:

- New Name
- Change Behavior

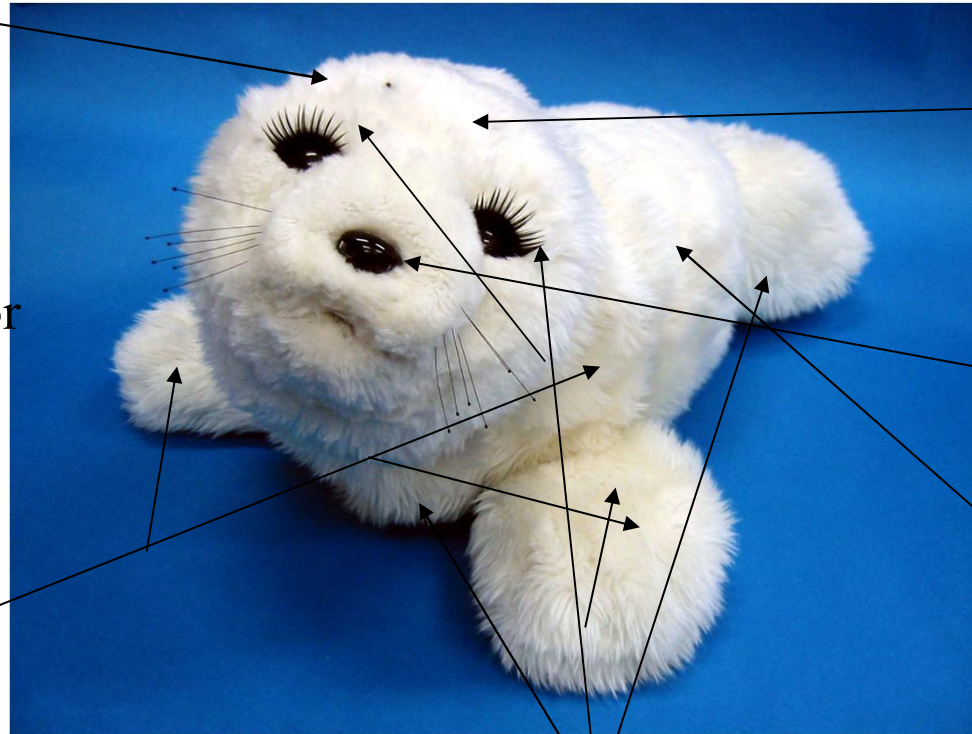
Size:

L:550 x W:290
x H:180 mm

Weight: 2.7 kg

Touch

- Ubiquitous Surface Tactile Sensor × 12
- Whisker Tactile Sensor
- Artificial Fur
(Anti-biotic)



Audition

Microphone × 3

Vision

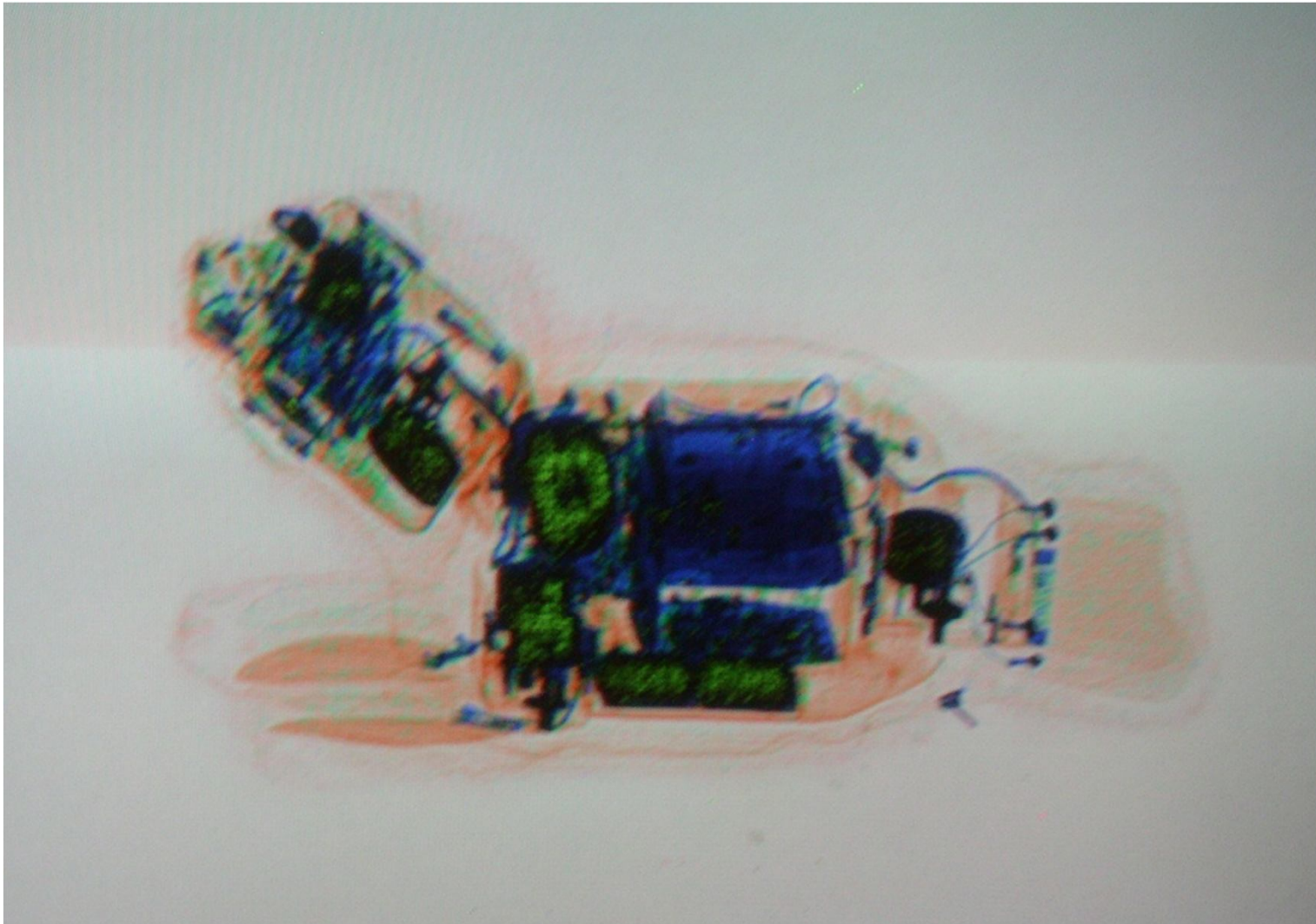
Light Sensors
× 2

Posture Sensor

Actuator × 7

neck(2), each front fin(1), rear fins(1),
each eyelid(1)

PARO's Inside (X-ray in NY, 2006)



Safety and Dependability

CE, RoHS, and other regulations



- z Anti-bacterial, Hair-Loss Prevention, and Soil Resistant Finish in Artificial Fur
- z Electromagnetic Shield
- z Coping with Strong Force by Humans
- z Easy Usage and Maintenance
 - y One Switch and Pacifier Type Battery Charger
- z Tough Structure
- z Drop Test
- z Stroking Test (100,000 times)
- z Anti-Electrostatic Voltage Test (20,000 Volt)

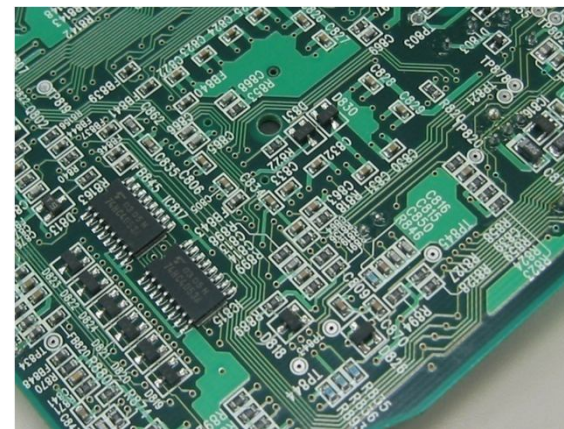
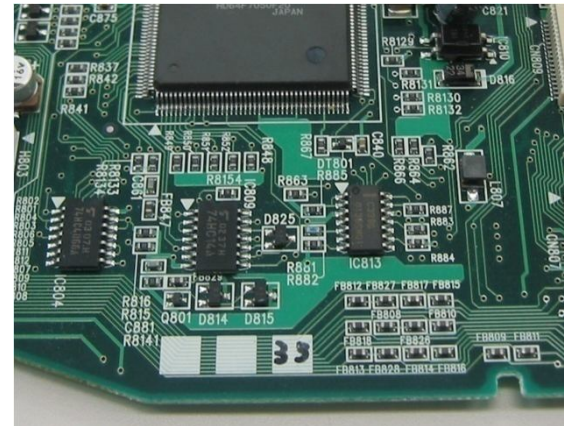
Technical Points



Ubiquitous Surface Tactile Sensor



Automatic Chip Moulder



Six Layered Print Circuit

Aesthetic Points

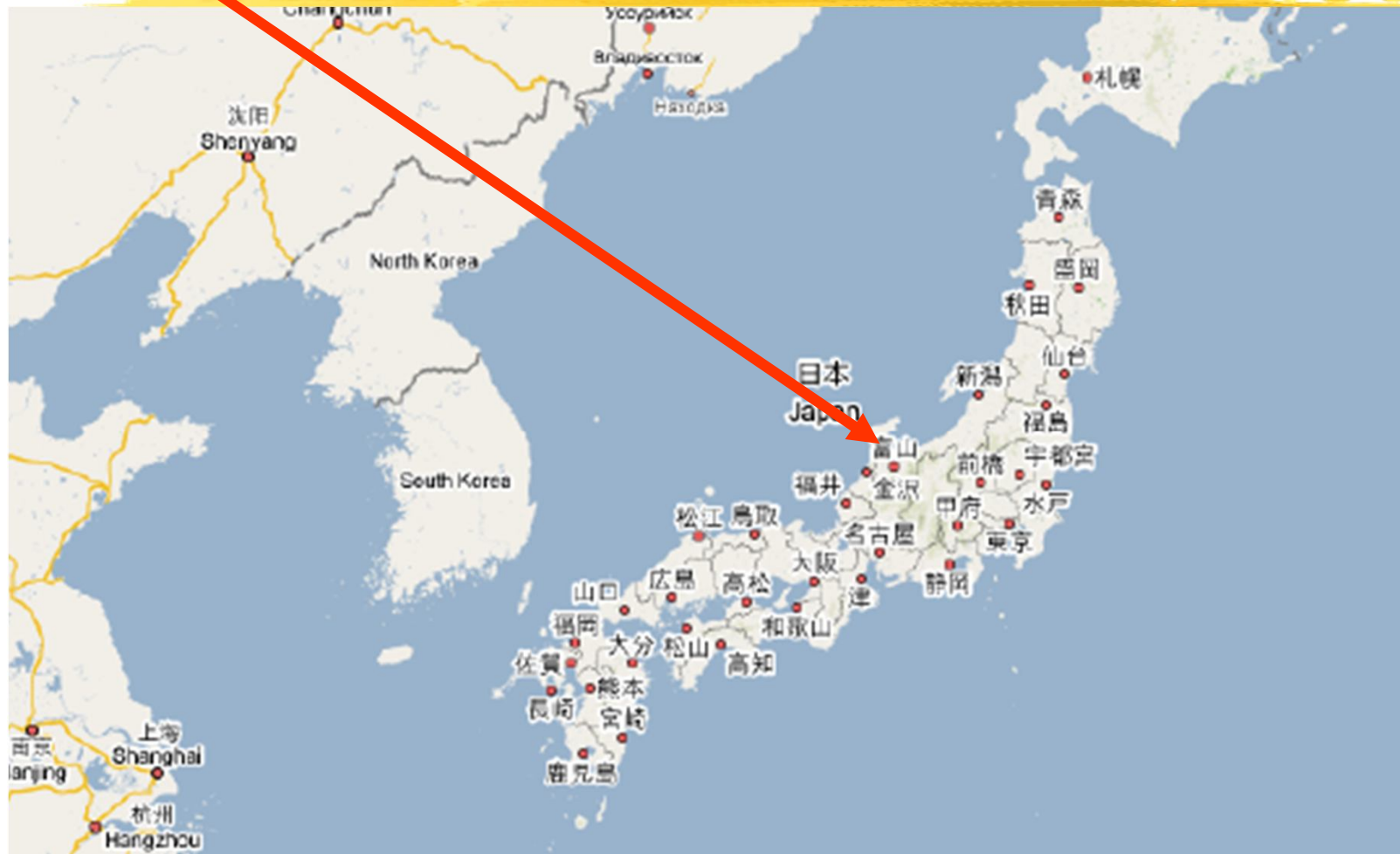


- z Kansei (Sensibility)
 - y Touch: Texture and Softness
 - y Holding: Weight, its Balance, and Warmness
- z Design
 - y Appearance
 - y Sound sampled by a real baby harp seal in Canada
- z Handmade for its Quality
 - y Eyelash
 - y Trimming: Each Paro has its own Face

Paro Factory



Toyama, Japan



Japanese Alps in Toyama



Japanese Alps from Ocean



Mountains



UNESCO World Heritage

Michelin ★ ★ ★



Integration of Art and Technology 1 in Nanto, Toyama, Japan



**Japanese Paper
1200 years old
Gokuyama, a World Heritage**

**Shosoin
(Emperor's Treasure
Warehouse)
in Nara**

和紙
1200年以上の歴史
奈良・正倉院にも保管されている
日本に和紙が伝わった直後には
五箇山での生産が始まっている

Integration of Art and Technology 2 in Toyama, Japan



**Festival of Decorated Floats
with Gold, Silk, Woodcraft, etc.
300 years old**



Karakuri Doll

Integration of Art and Technology 3 in Toyama, Japan



Woodcraft
260 years

Aesthetic Points Handmade for Quality



Eyelashes

Trimming

Musee des arts Decratifs, Louvre Paris, France (Dec., 2008)



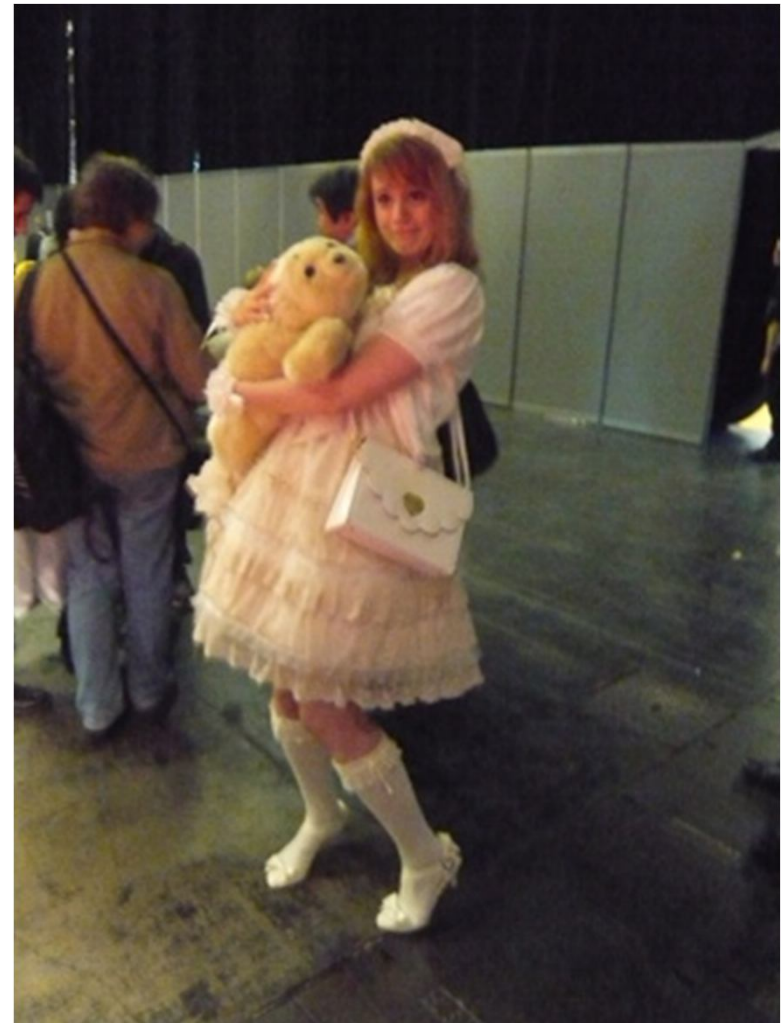
Museum of Modern Art (MoMA) NY

Feb. 21st and 22nd, 2009

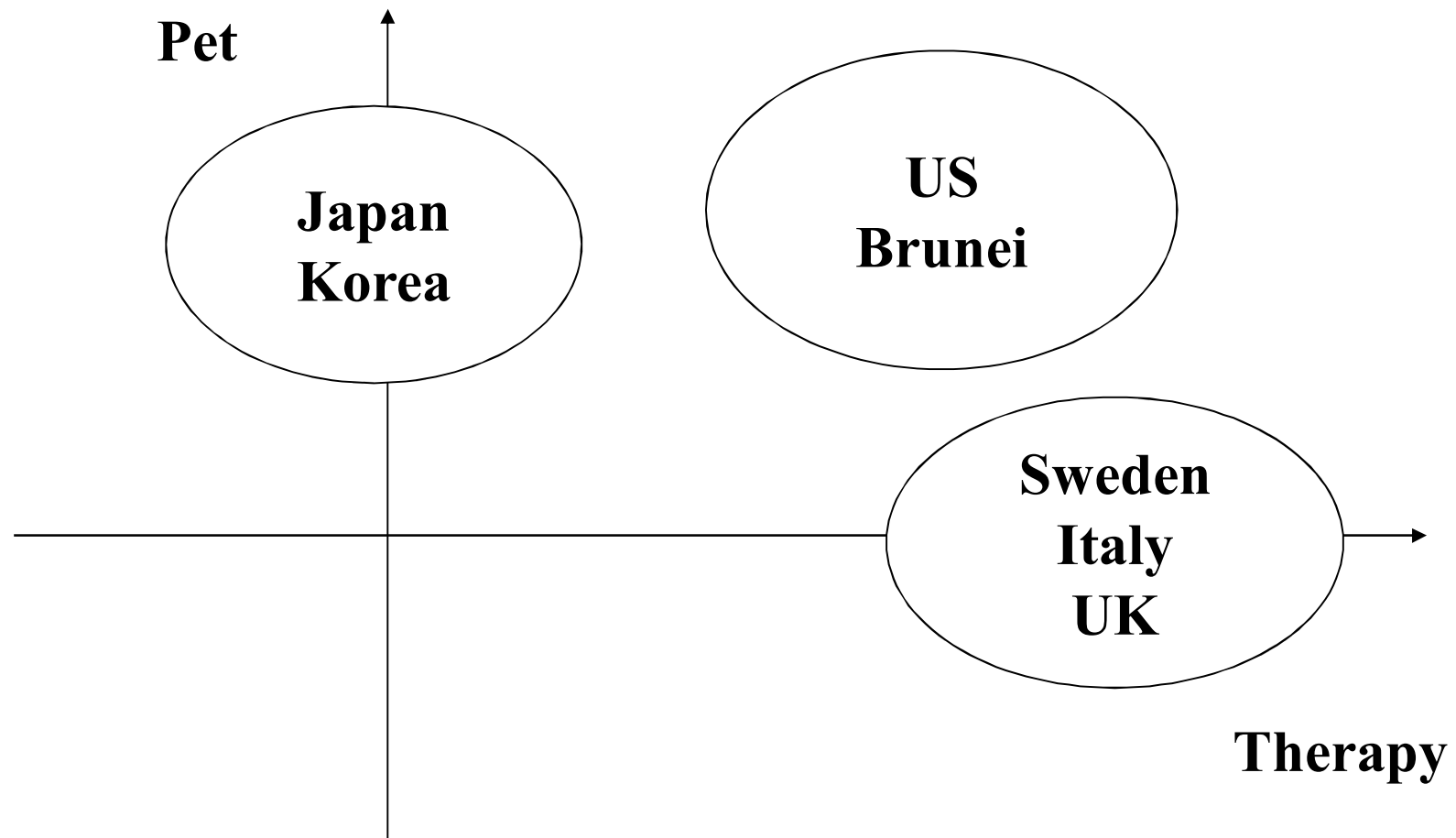


Japan EXPO in Paris, France

July 7-8, 2012



Expectation to PARO by Questionnaires to 2000 people in 7 Countries



Paro on the World Map (in about 30 countries)



- Place where Paro has been used

About 3000 PAROs in Practical Use

- z 2000+ PAROs in Japan since 2005
 - y 60% are individuals, and 30% are institutions
- z About 300 PAROs in Denmark since 2009
 - y 70%+ municipalities adopted PAROs
- z NL, SE, DE, CH & other European countries
 - y 100% are institutions
 - y Seminar and Certification
 - y Health Insurance of Niedersachsen, Germany
- z In the US, since Dec. 2009
 - y Medical Device by FDA

Robot Therapy at Karolinska Hospital in Stockholm, Sweden (Oct. 2003 -)



Astrid Lindgrens Pediatric Hospital



LIVA

Boston Higashi School for Children with Autism (Feb. 26, 2009)



Cancer Patients

Chemotherapy with PARO



20 Women with Ovarian Cancer (49-71: ave. 67)

Chemotherapy for 3 – 5 hours

Interaction with PARO reduce

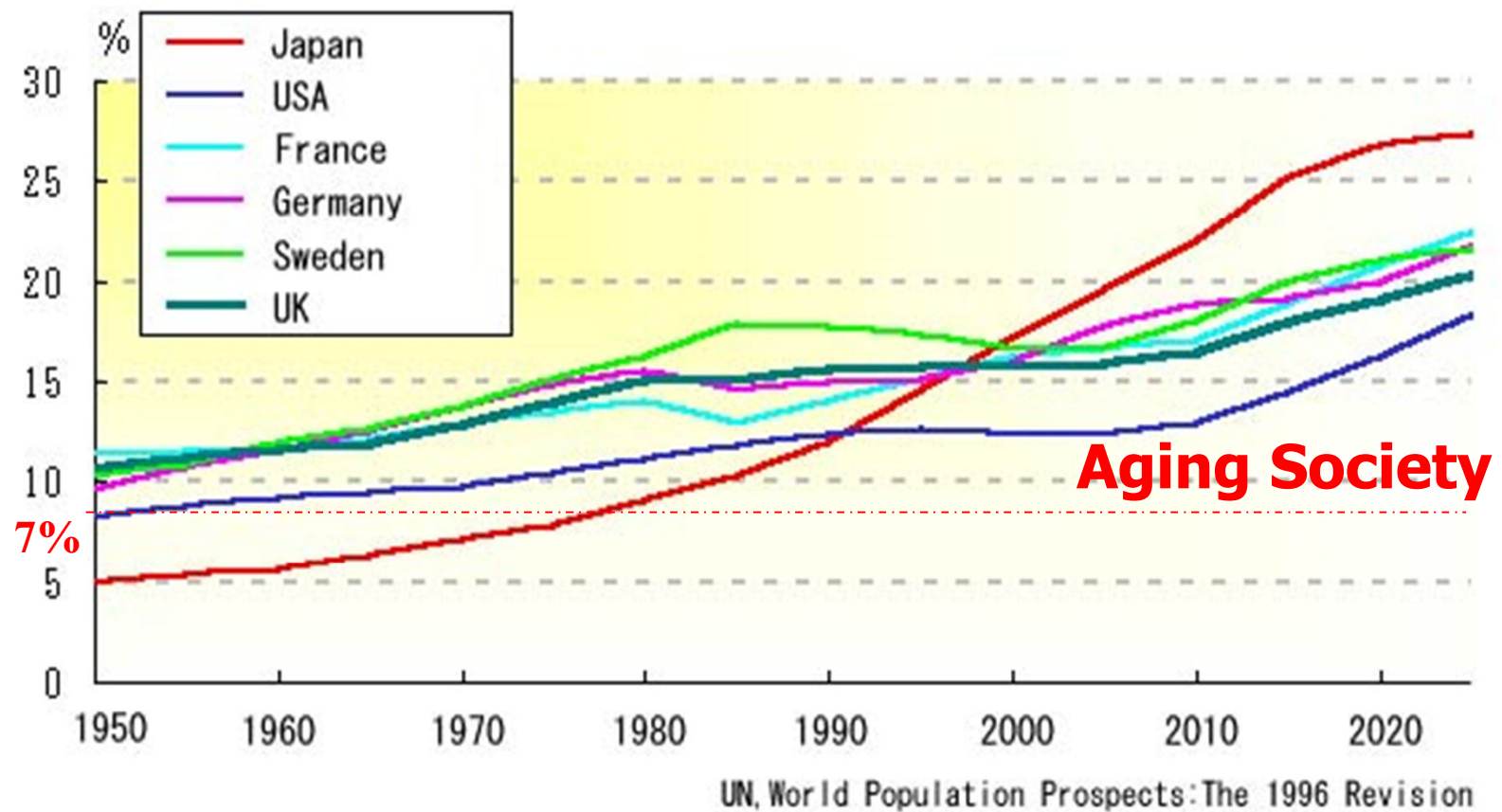
- Pain ($P = .04$), Fatigue ($P = .034$), Anxiety ($P = .036$)
- 9 factors of Quality of Life on Health ($P = .03$)

UC Irvine and Long Beach Memorial Hospital, CA, USA

(Society of Gynecologic Oncologists (SGO) 44th Annual Meeting on Women's Cancer, 351, 2013)

Aging Societies

Ratio of people 65 years old and over against total population



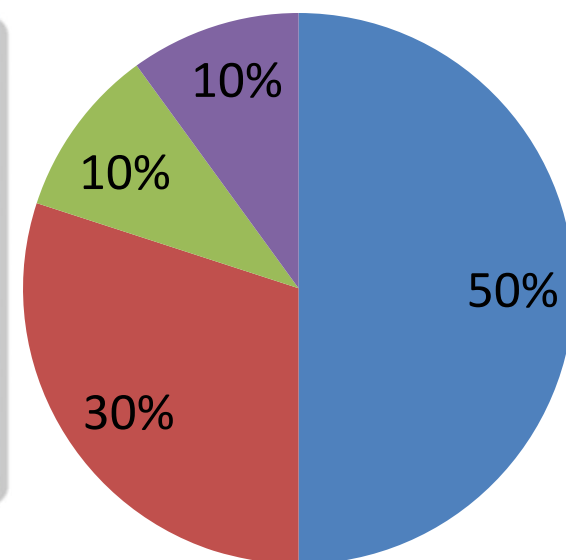
Dementia

図表 2-1-11 認知症高齢者数の現状と将来推計



資料：厚生労働省老健局「高齢者介護研究会報告書『2015年の高齢者介護』」（2003年6月）

(注) ここでいう「認知症高齢者」は、認知症自立度Ⅱ（日常生活に支障を来するような症状・行動や意思疎通の困難さが多少見られても、誰かが注意していれば自立できる。）以上の者をいう。



In Japan

4.6 M People with Dementia

4.0M Mild Cognitive Impairment

- アルツハイマー型認知症
- 血管性認知症
- レビー小体型認知症
- その他



Observed Effects for Elderly with Dementia



- z Improved Communication
- z Improved Sociability
- z Reduced Aggression
- z Reduced Wandering

Alzheimer Patient with Anxiety (Italy, since Feb. 2005)



Wandering Person by Dementia (Italy, since Feb. 2005)



Sundown Syndrome (Alzheimer's Disease, 97y Female)

* ご利用者データ [Aさん] *

年 齢: 97歳

性 別: 女性

要介護度: 3

認 知 症: アルツハイマー型認知症

周辺症状: 夕方になると帰宅願望が出現する。この方は他のご利用者のお世話をしたがる傾向にあり、他のご利用者も影響されて帰宅願望が出現してしまうこともある



PARO for Sundown Syndrome



高齢者の履歴・行動を分析:

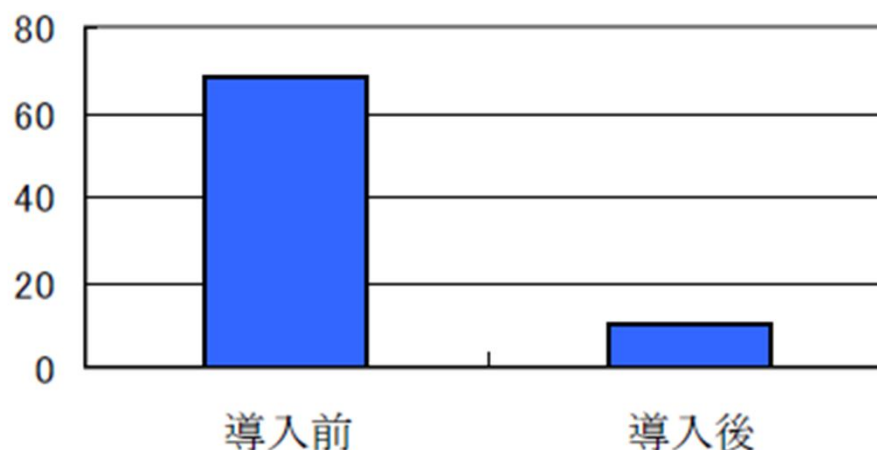
- ・最初はパロを嫌がった
- ・過去に犬を飼っていた
- ・「さぶろう」という名前の犬
- ・パロに「さぶろう」の名前
- ・「さぶろう」のお世話を依頼
- ・定期的なふれあいを開始

帰宅願望時

- ・パロとのふれあい
- ・不安の軽減
- ・精神的安定
- ・介護者の負担を軽減
- ・他の利用者へも目配り

Suppression of BPSD

(Behavioral and Psychological Symptoms of Dementia)



**Dementia Behavior
Disturbance Scale:(DBD)**

- ・BPSDがひどく家族が介護困難に
- ・GHへ、家族は面会拒否
- ・パロによりBPSDを抑制
- ・家族の面会が再開した

Robot Therapy for Demented Elderly



DIMENTION:
EEG Method for Estimating Neuronal Impairment

Procedure of Experiment



EEG recording
(3 min)



Robot Therapy
(about 20 min)

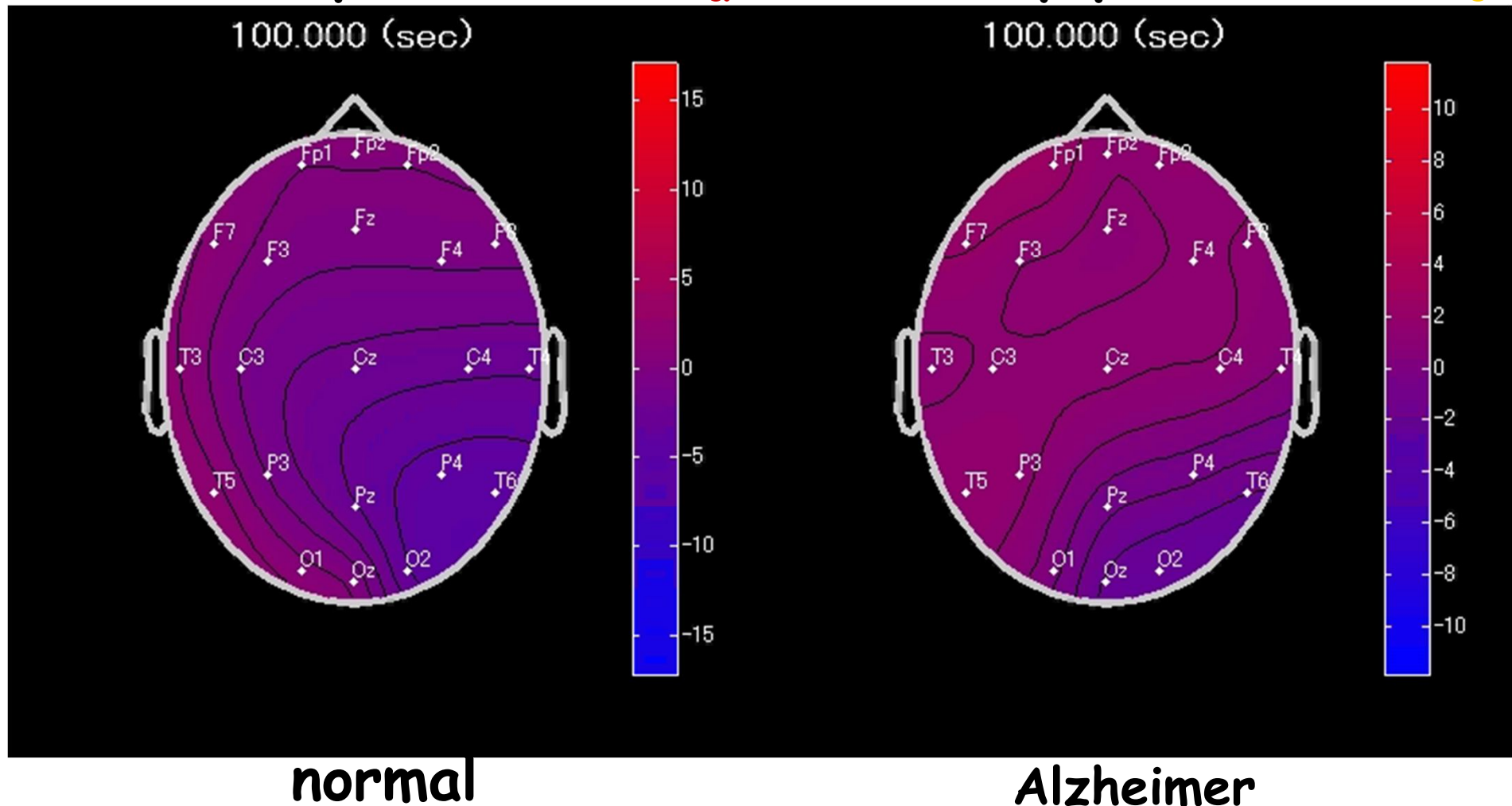


EEG recording
(3 min)

Dementia \Rightarrow non-uniform neuronal impairment

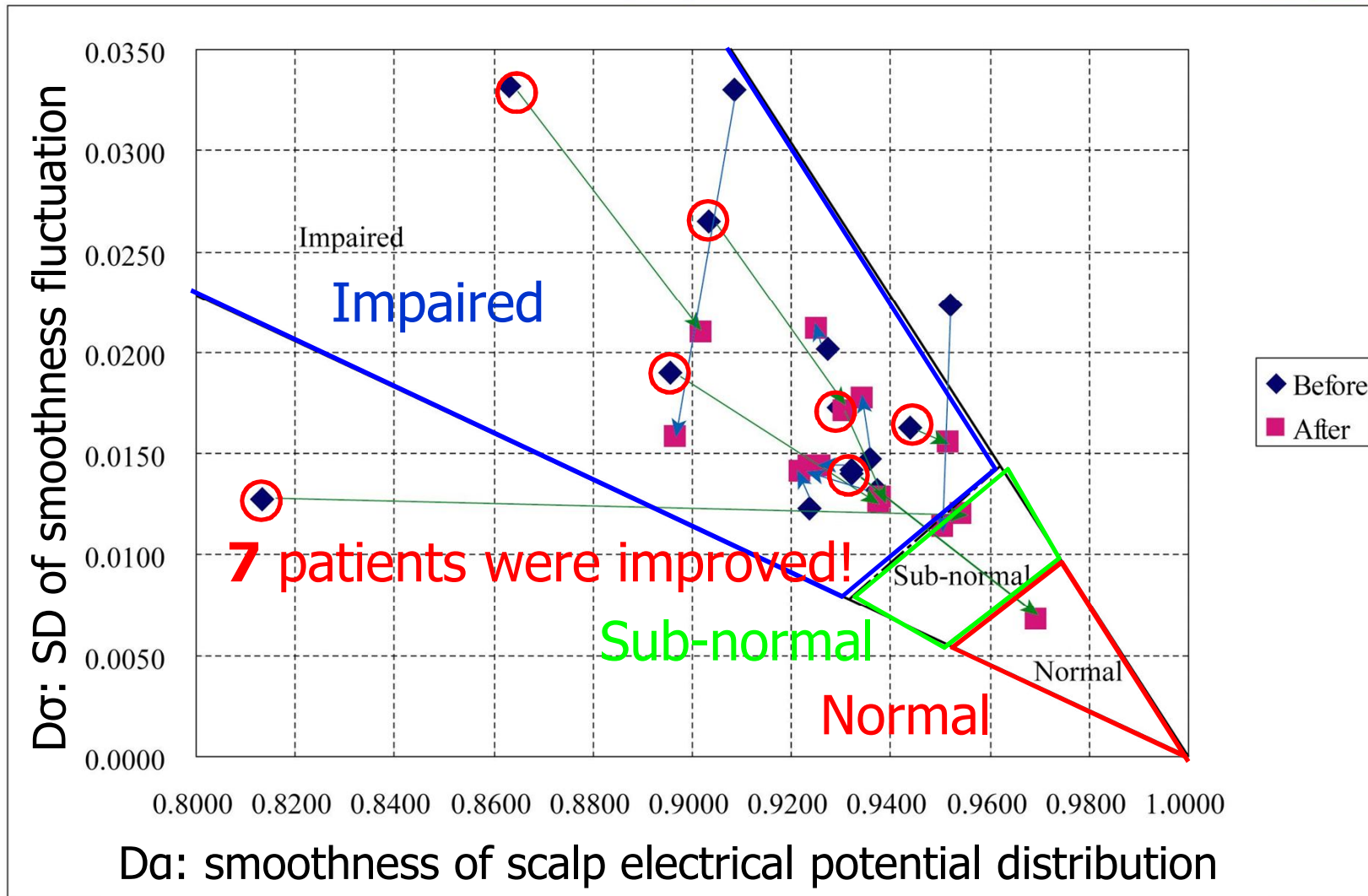
\Rightarrow unstable distortion of the scalp potential

distortion parameter= D_{α} ; instability parameter= D_{σ}

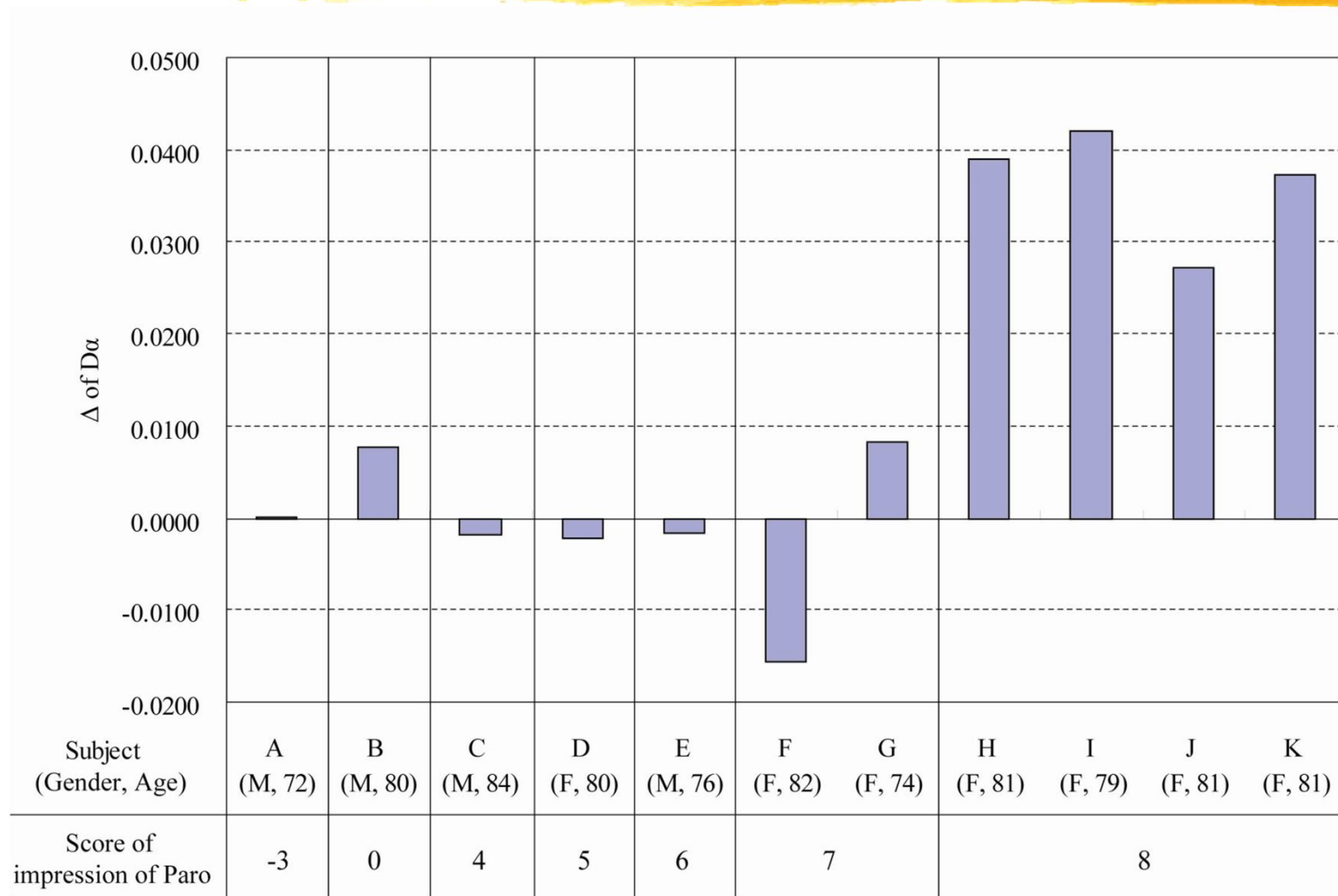


Experimental Results (IEEE EMB Magazine)

(14 subjects)



Relationship between Impression of Paro and its Efficacy on 11 Patients



Study design

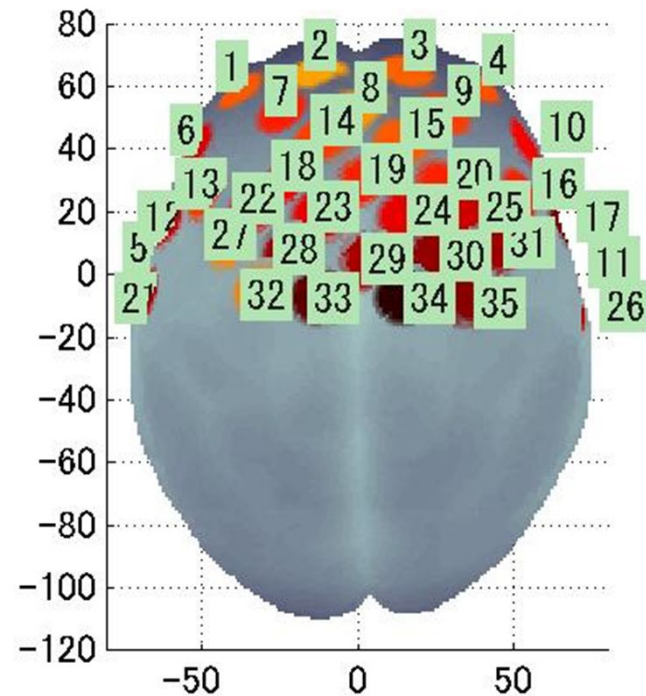
Participants :

10 healthy participants (8 males and 2 females)

Aged 21-33

Method

- z Set up the NIRS probes on the participants' head mainly frontal lobe area
- z Examined brain activity of 35 channel areas by fNIRS (OMM2001, Shimazu Corporation)



Study design2

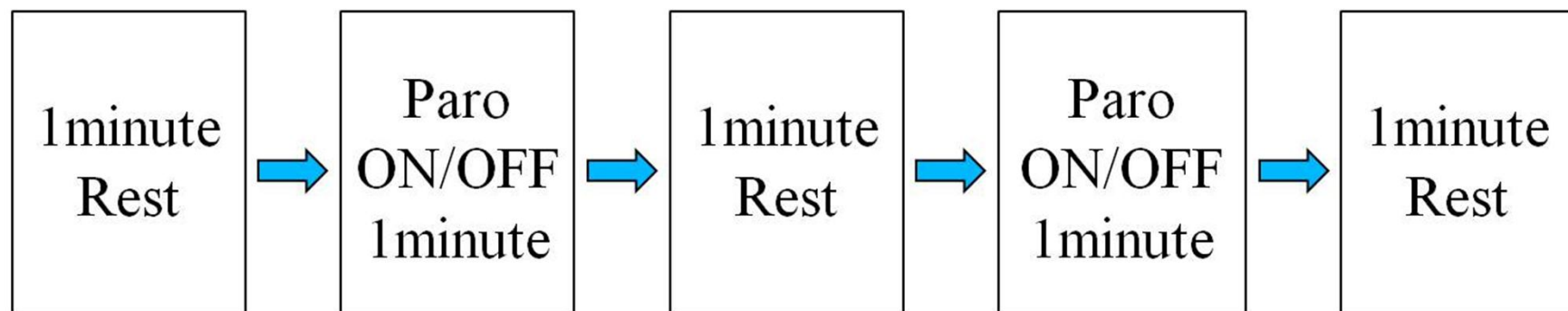
zStress task: Word association

It was conducted to balance the participants' brain activity

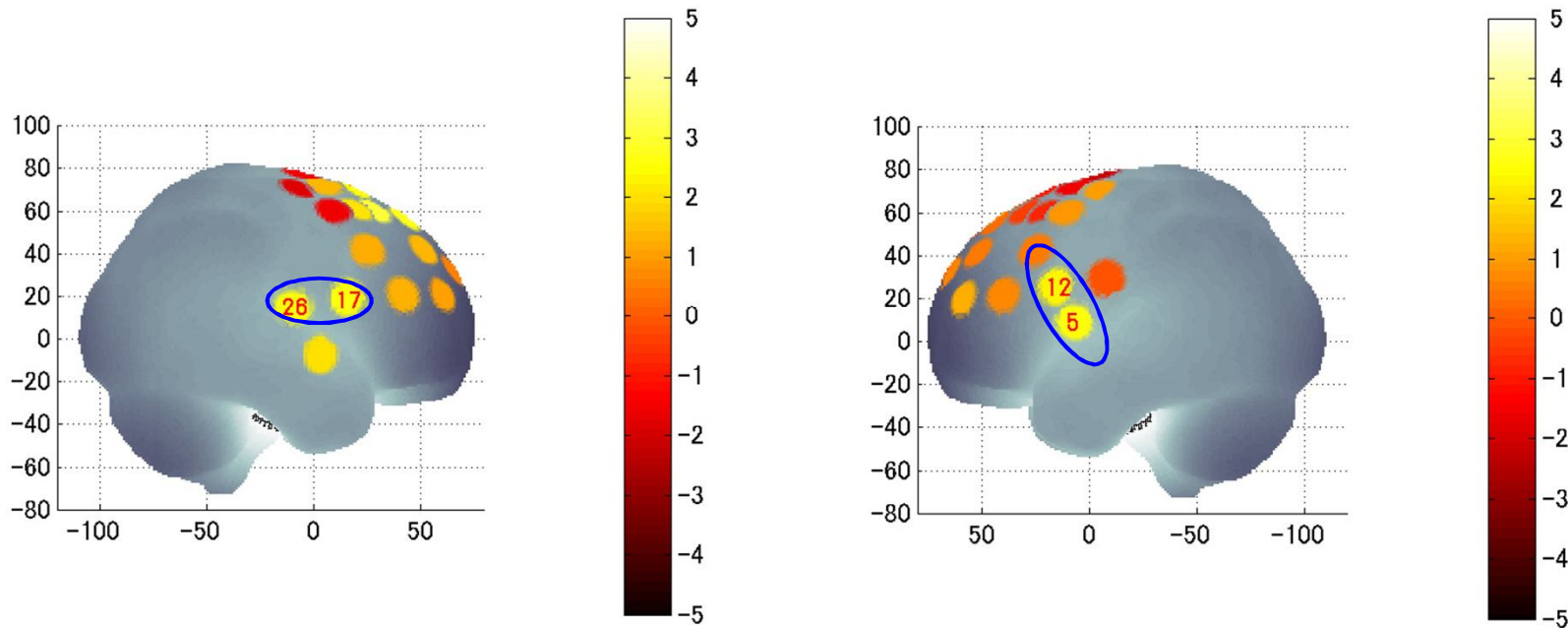
zExperimental tasks: Paro ON/OFF

Participants were instructed to interact with Paro physically and verbally

zEach task had one minute and there were one minute rests conditions before and after the tasks



Brain activity during Paro ON compared with before the task



channel 5, 11, and 12 were significantly activated ($p < 0.05$) in PARO ON task compared with before the task

Recovery of Speech by Biofeedback through interaction with PARO

An immigrant from the eastern EU who lost speech in Danish by dementia



Patient talks to PARO in Danish



She can talk with others in Danish

Dementia Center, Copenhagen, Denmark



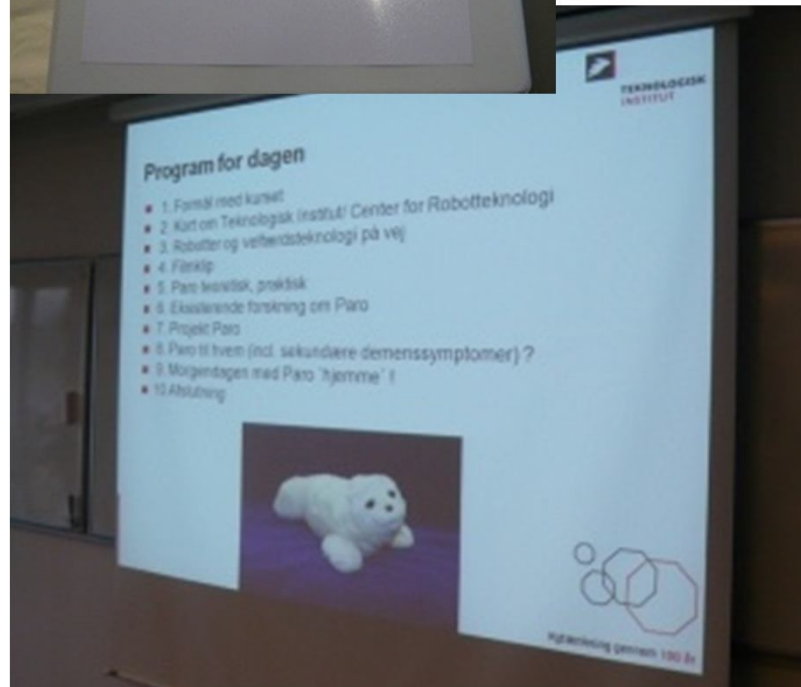
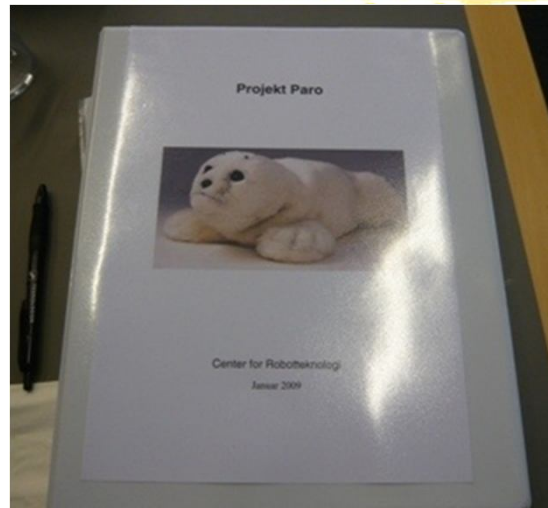
**From 2006 to 2008, PARO was tested.
70 out of 98 municipalities have been using PARO**

PARO in Denmark

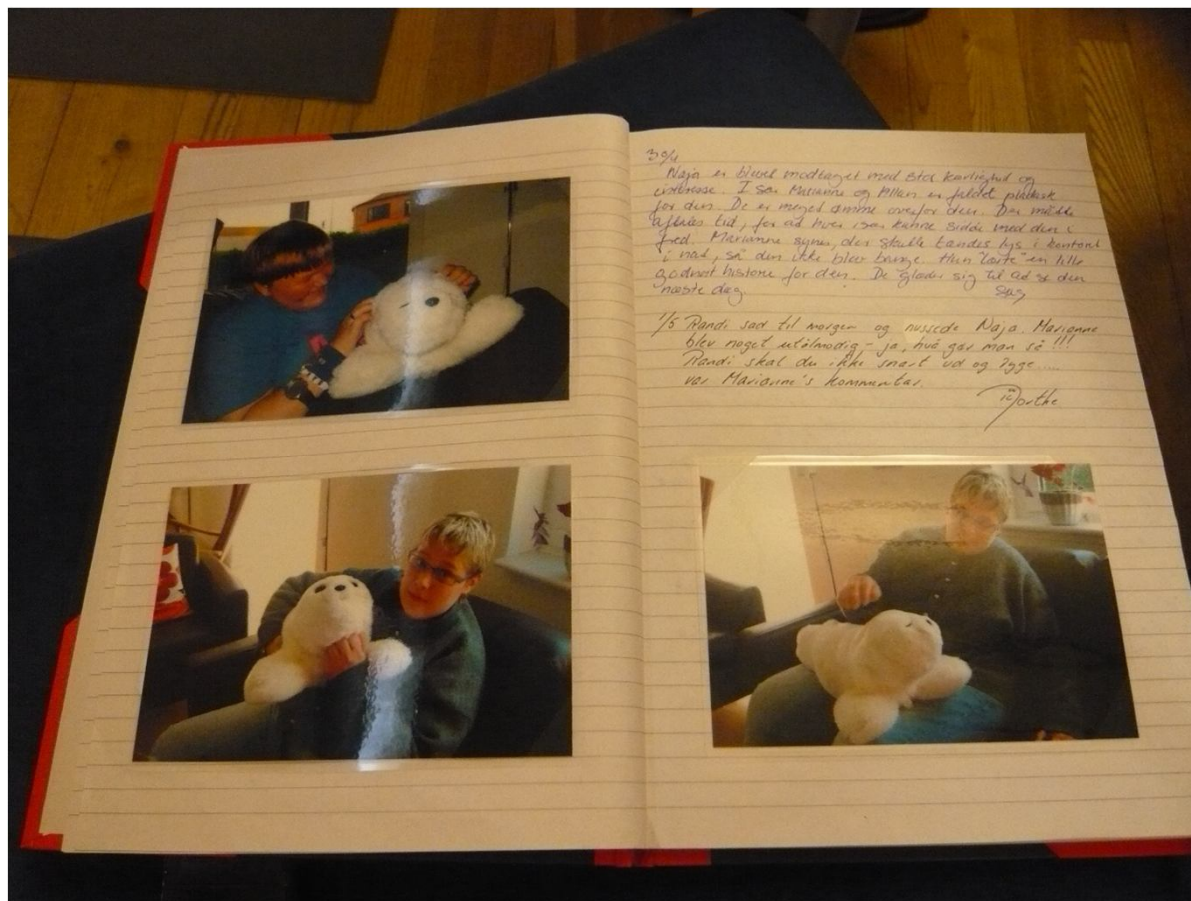
Jun 2011 (NHK Today's Close Up)



Seminar for Therapists and Care Givers by DTI



Users Meeting in Denmark



Collection of Data
DTI
AIST

Other Area (in Denmark)



Down Syndrome & Dementia



Brain Injured Patient

The Usage of PARO for Elderly who need Help at Home

- In the beginning of 2012, 12 PARO's were introduced in the home care service.
- Procedure of introducing PARO in the home of elderly people who need help:
 - Identification of elderly citizens who may benefit from PARO
 - Inform and seek permission from relatives before introducing PARO
 - Bring PARO to the home of the elderly when visiting to provide a specific service related to personal or practical help



Source: Danish Technological Institute



Group Home in Amsterdam, Netherlands Since July 2007



Distribution of PARO since 2011
100 Paros at about 70 institutions



Clinical Test by ZUYD Univ.



Six locations

- ✓ Proteion
- ✓ Hornerheide
- ✓ Lemborgh
- Zilverlinde
- St Jansgeleen
- Sevagram

Finished Juni 2013.

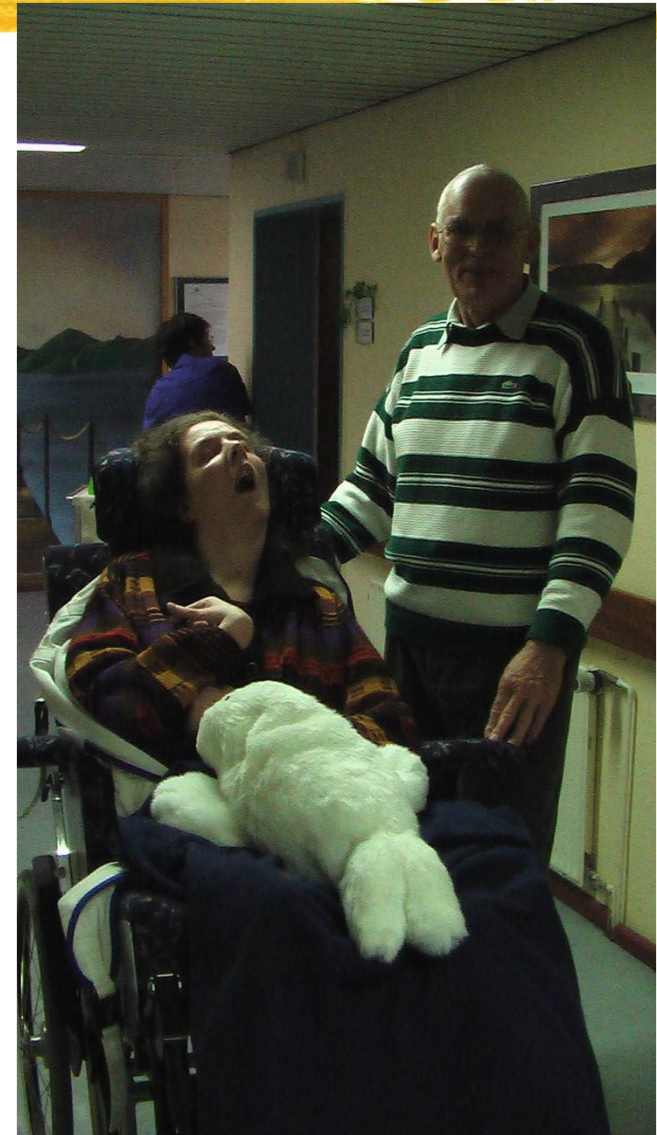


Nursing Homes in Germany since Nov. 2006

Christinen-Stift, Baden-Baden



Pflege- und Therapiezentrum,
Lehre-Wendhausen



Press Release in Germany

Pressemitteilung

Seelze, 23. September 2010

Beziehungen pflegen UG (haftungsbeschränkt), Seelze

Key Words: Altenpflege, Gesundheit, Ambient Assisted Living, Technologien, Robotik



Robbenroboter PARO vor kommerziellem Start in Deutschland!

Start-Up aus Hannover ist Ansprechpartner rund um PARO für Deutschland

Healthcare Insurance Covers Mobile Service with PARO in Land Niedersachsen

Roboter-Robbe für Pflegeeinrichtungen

Therapie-Angebot von der Wolfsburg AG

Ein neues Angebot gibt es ab Mai für Wolfsburger Pflegeeinrichtungen: Die Wolfsburg AG setzt auf Robben-Betreuung. Dabei haben Kinder und Demenzkranke Kontakt mit therapeutischen Plüsch-Robotern in Robben-Form, die auf Berührungen oder auch Rufe reagieren.

Das Unternehmen „Beziehungen pflegen UG“ wird zukünftig in Kooperation mit der Wolfsburg AG den Robben-Besucherdienst in Pflegeeinrichtungen und ambulanten Diensten einrichten. Die Robben mit dem Namen Paro sind mit einem Plüschfell überzogen und ähneln dem Baby einer Sattelrobbe. Sie sind mit

verschiedenen Sensoren ausgestattet, so dass sie auf Rufe oder Berührungen von Patienten reagieren, zum Beispiel mit Kopfbewegungen oder Geräuschen. So sollen sie das Pflegepersonal unterstützen.

Paros werden vor allem bei Demenzkranken und Kindern mit Behinderungen eingesetzt. „Ich bekam eine Gänsehaut, als ich die Arbeit mit einem Paro zum ersten Mal gesehen habe“, so Shanna Weiser von der Wolfsburg AG. Auch für den Privatgebrauch seien die Robben geeignet, man muss jedoch mit Kosten in Höhe von 5000 Euro rechnen.

● Weitere Information gibt die Wolfsburg AG unter Tel. 05361/8974554.



Spaß mit der Roboter-Robbe: Der so genannte Paro ist ein Angebot für Wolfsburger Pflegeeinrichtungen.

- z Wolfsburg AG, a subsidiary of Volkswagen, started to provide mobile service with PARO for elderly with dementia at home since May 2012

Donation of Paro from BBVA to Queen of Spain, Sep. 21, 2009



Robots del BBVA para la lucha contra el alzhéimer

BBVA hizo entrega el lunes a la Fundación del Centro de Alzhéimer Reina Doña Sofia de Madrid de dos robots terapéuticos para el tratamiento con enfermos de alzhéimer. El robot *Paro*, con forma de peluche de una foca, está dotado de microsensores que le permiten res-

ponder a estímulos como el tacto, la luz o la voz. En la imagen la ministra de Ciencia e Innovación, Cristina Garmendia; la reina Sofia; Ramón Monell, director de Tecnología y Operaciones de BBVA, y David Zafrilla, del Observatorio Tecnológico de BBVA, con el robot.

Certification of Medical Device by FDA in the US in Sep. 2009



DEPARTMENT OF HEALTH & HUMAN SERVICES

SEP 21 2009

Food and Drug Administration
10903 New Hampshire Avenue
Document Mail Center - WO66-G609
Silver Spring, MD 20993-0002

Re: K091876

Trade Name: Paro Therapeutic Robot

Classification Regulation Name and Number: Biofeedback Device

21 CFR 882.5050

Regulatory Class: Class II Exempt

Product Code: HCC

Dated: June 22, 2009

Received: June 23, 2009

Vinson Hall, McLean, VA, US



Greenwich Woods Health Care Center, CT



Pictures by "Greenwich Time"
On July 18th, 2011

Others: Greenwich Post

Cases in the US

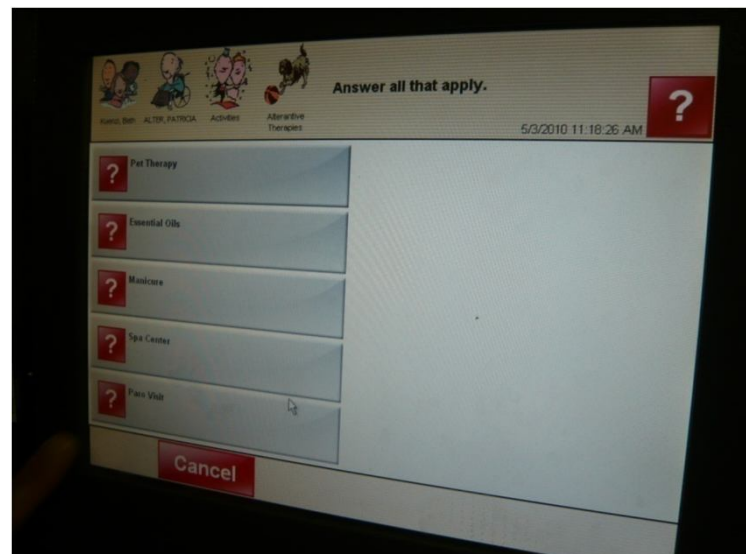


VCS Elderly Institution
In Pittsburgh



VA Medical Center
In Washington DC

Document System



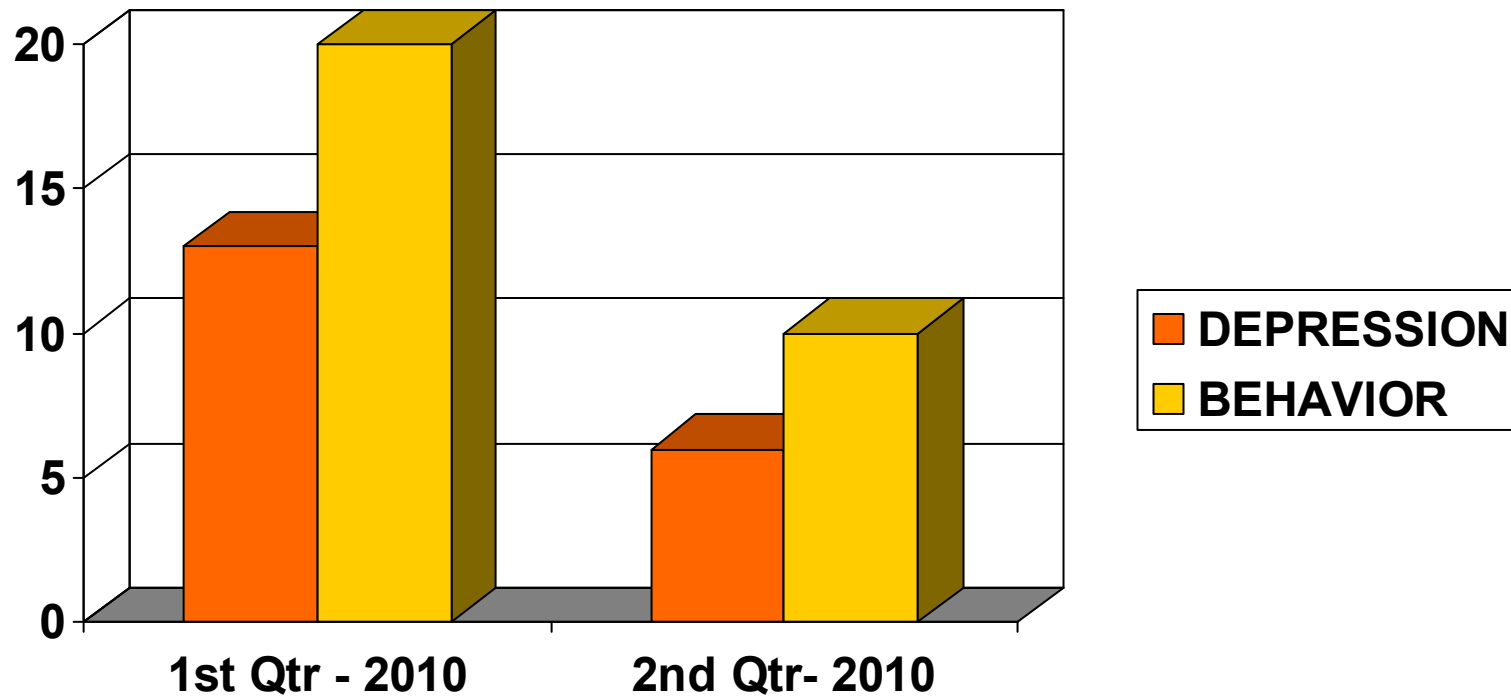
News Video (Dec. 23, 2010)

Marian Manor, Pittsburg, PA



TOTAL RESIDENTS WHO TRIGGERED

(from Marian Manor and Vincentian Home)



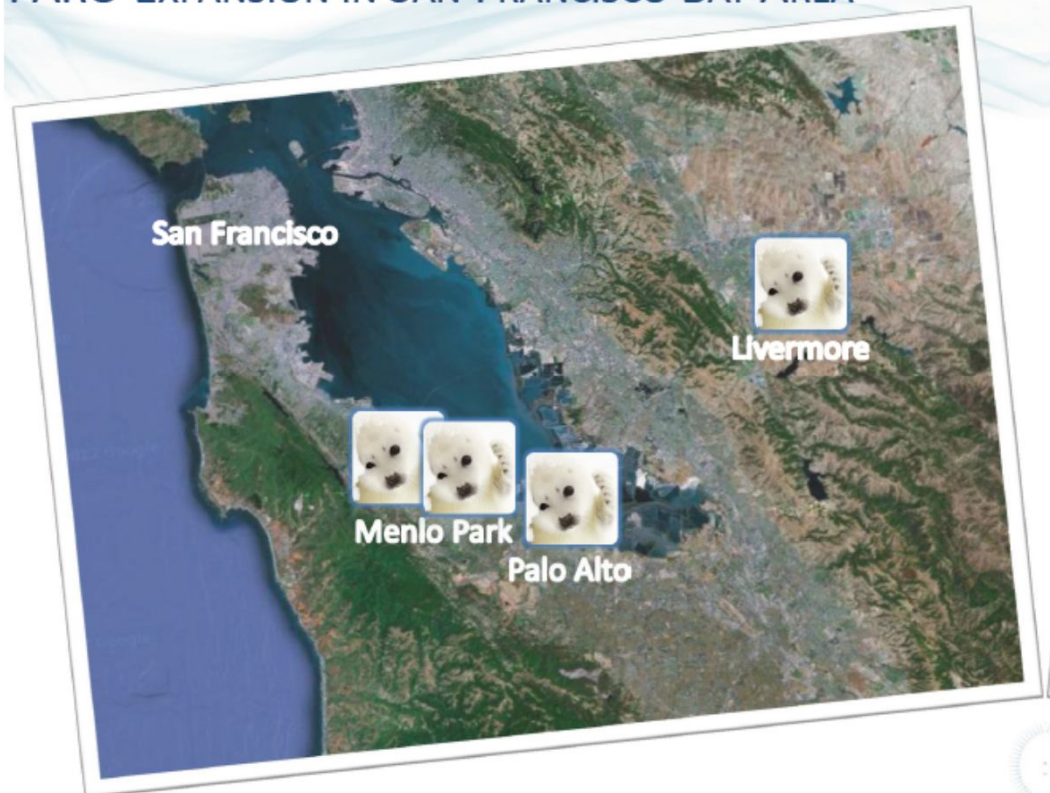
VA Palo Alto Health Care System



PARO Study

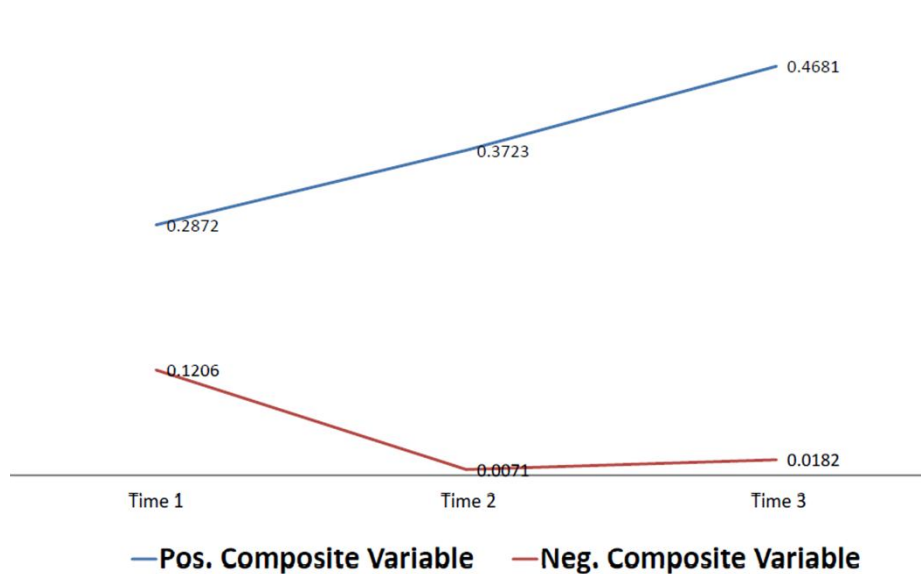
- Clinical Test at Four Locations
- Development of Protocol of Usage

PARO EXPANSION IN SAN FRANCISCO BAY AREA

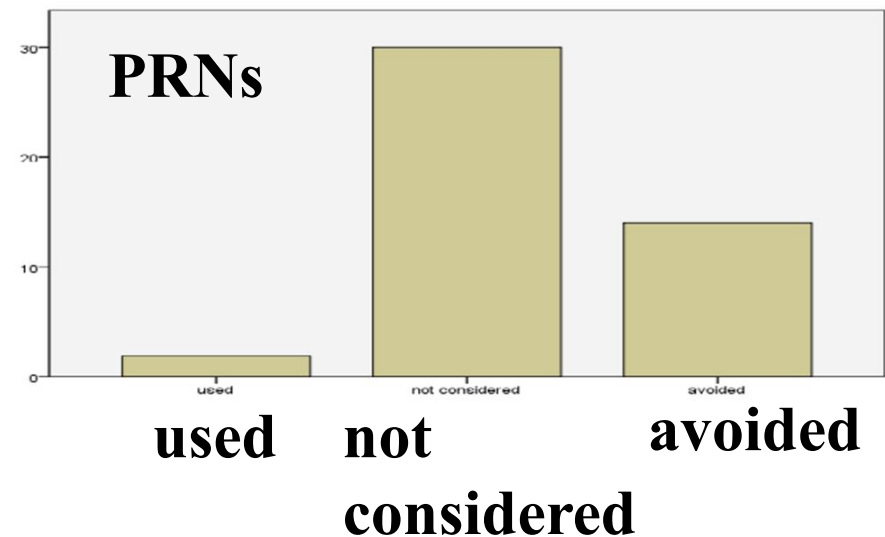
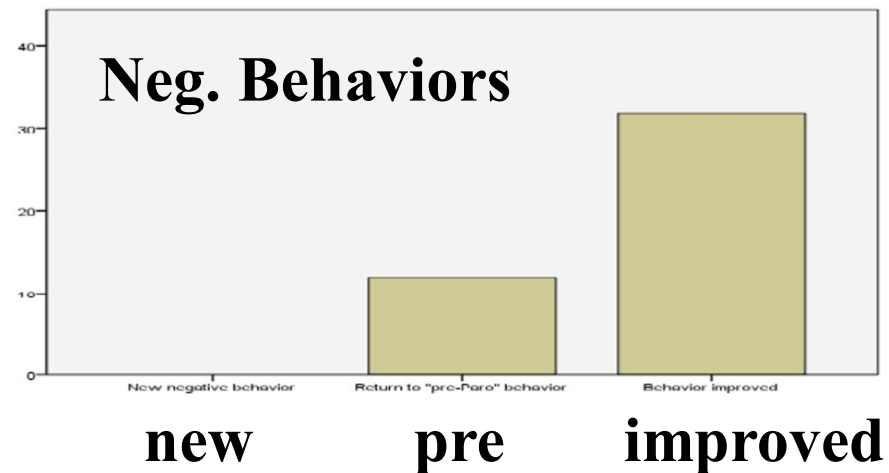


Results at VA (presented APA 2012)

Negative Behaviors and PRNs



14 male residents
VA PAHCS in Menlo Park
47 Observation for 10 months



Visitation Therapy by Passage Hospices in Illinois and Michigan

Visitation Therapy: 400+ nursing homes
Elderly: about 6,000
Records: cases



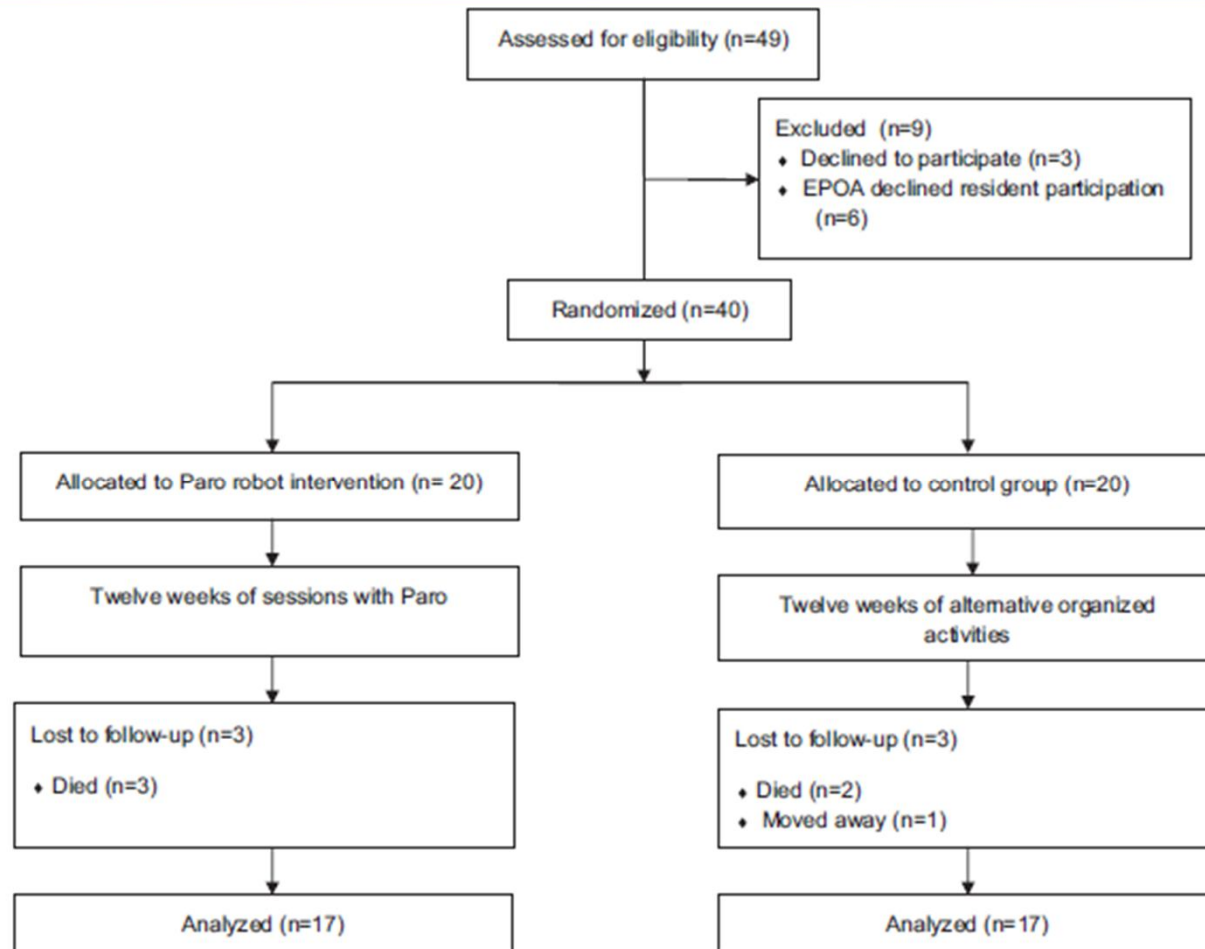
Tower Hill Health Center
South Elgin, IL
(by Daily Herald)



Atrium Health Care and
Rehabilitation Center
Cahokia, IL

RCT by Auckland Univ., NZ

N=40



PARO is capable of improving loneliness in older people

JAMDA: Journal of the American Medical Directors Association



PARO should be considered in future care plan

Griffith Univ., Brisbane, AU

- z RCT (Randomized Controlled Trials)
- z N=18, QOL-AD and Pleasure are improved
- z Large Scale RCT



Cover Page of Australian Journal of Dementia Care (Oct./Nov., 2013)

**Australian Journal of
DementiaCare**

For all who work with people with dementia

Vol 2 No 5 October/November 2013



How can robots help?

Prof. Wendy Moyle

Board Member of
ICD-11
Classification of Behavioural and
Psychosocial Symptoms of
Dementia
WHO

Lancet Neurology

Sep. 2013



In Context

Dolphins, dogs, and robot seals for the treatment of neurological disease

A growing body of evidence suggests that animal-assisted therapies and activities involving all kinds of real and even robotic animals can have beneficial effects in people with neurological disease or mental illness. But what is the quality of that evidence and do these interventions really provide any health benefits? Adrian Burton Investigates.

Shatin Hospital, CUHK

- z Therapy for Out-patient Dementia by OTs
- z Evaluation of Therapeutic Effects
- z Developing Protocol



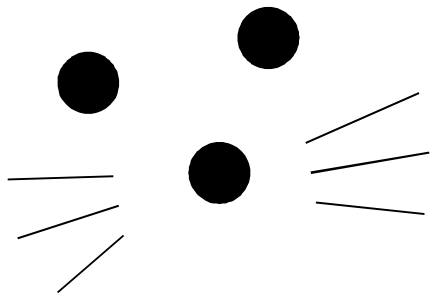
PARO as a Staff of Day Care Service Center, ELCHK



9th Generation of PAROs are coming soon



The End



paro.jp