COGAIN

Eye Tracking Impact on Quality-of-Life
The case of ALS Patients in Torino

A. Calvo, A. Chiò, P. Ghiglione, V. Pasian, A. Vignola
Centro SLA, Ospedale “Molinette”, Torino, Italy

E. Castellina, F. Corno, L. Farinetti
Politecnico di Torino, Torino, Italy

COGAIN NoE is funded by the EU IST 6th framework program.

Outline

- Objective
- Methodology
- Experimental settings
- Case studies
- Quantitative results
- Conclusions

QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

Objective

Objective

- To evaluate if and when eye tracking technologies have a positive impact on ALS patients' lives
  - Adopting Quality of Life assessment scales
  - Experimenting with off-the-shelf devices
  - Involving a large user base

QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

Methodology

Methodology (1/2)

- Each patient uses an eye tracking system
  - For several consecutive days
  - In his/her own domestic environment
- Multi-disciplinary team
  - Neurologist
  - Psychologist
  - Speech therapist
  - Engineer

Methodology (2/2)

- Three contacts during the lending period
  - Initial contact, training and evaluation
  - Mid-period check
  - Final evaluation

Patients

- Recruitment criteria
  - Unable to speech intelligibly
  - Able to understand the aim of the study
  - Able to give an informed consent
  - Basic to good level of computer literacy
- Various degrees of hand function impairment

Support team

- Neurologist
  - Selects patients
- Psychologist
  - Evaluates quality of life throughout the experimentation
- Speech therapist
  - Trains patients in eye tracking usage and related applications
- Engineer
  - Provides technical support and troubleshooting

Initial meeting (1/2)

- Assessment questionnaires
  - Quality of life, using the Mc Gill Scale
  - SWLS, Satisfaction With Life Scale
  - Depression, with the Zung Depression Scale
  - Perception to represent a burden, with the Self-Perceived Burden Scale

Initial meeting (2/2)

- Initial training to patient and caregiver on
  - Calibration and usage of the eye tracking system
  - Applications used in eye tracking mode
    - Writing
    - Communication
    - Internet
    - Windows
    - … according to user's needs and interests

During the period

- Hotline support with psycologist, speech therapist and engineer
  - Usability issues
  - Technical problems
- Mid-period call to check about progress or problems

Final meeting

- Second round of assessment questionnaires
  - The same 4 scales as the initial meeting
  - The standard COGAIN questionnaire
  - A specific questionnaire focusing on qualitative aspects and feelings

QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

Experimental settings

Equipment

- Eye Response Technologies' ERICA Standard System
- Assistive and Communication software
  - ERICA keyboard and mouse emulators
  - Sensory Software's The Grid
- Standard Windows and Internet applications
- Personalized software

Study population (1/2)

- 16 patients
  - 12 men, 4 women
  - Age: 32 to 78 (average 45)
  - 7 patients are tracheotomized
  - 8 patients have PEG
  - 6 patients are anarthric and 7 have a severe disarthria

Study population (2/2)

- All patients showed a strong interest in eye-tracking systems
  - Most of them had already looked for information about this technology

Experimentation period

- Experiments from April 2006 to August 2007, still ongoing
- Each patient received the eye tracker for a one-week period

Example usage during the week

QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

Case studies

Case number 1: Marco (1/2)

- Marco is 47 and lives in his house with his family
- Before the disease he was a traveling salesman
- Currently he uses a communication system with a computer and a foot switch

Case number 1: Marco (2/2)

- When he tried the Erica system he was very excited; he used a screen keyboard for communication and for sending emails quickly and easily
- Now he has a lot of problems with his current system because he has less and less movement on his feet
- He wants this system but he hasn’t enough money; the Piemonte Regional Government denied him a grant

Case number 2: Paolo (1/2)

- Paolo is 52 years and lives with his wife
- He was and still is a web designer
- He currently uses two mouse devices, one for moving the cursor and the other for clicking

Case number 2: Paolo (2/2)

- He needs the eye tracker for his work, only, because he successfully uses labial movements for communication
- He uses many programs for his work, and tried them on the Erica system. The results were positive and he wants to buy the software and camera add-on to his computer
- In the past he tried the MyTobii system but he didn't like it because «it doesn't work well with web design programs»

Case number 3: Domenico

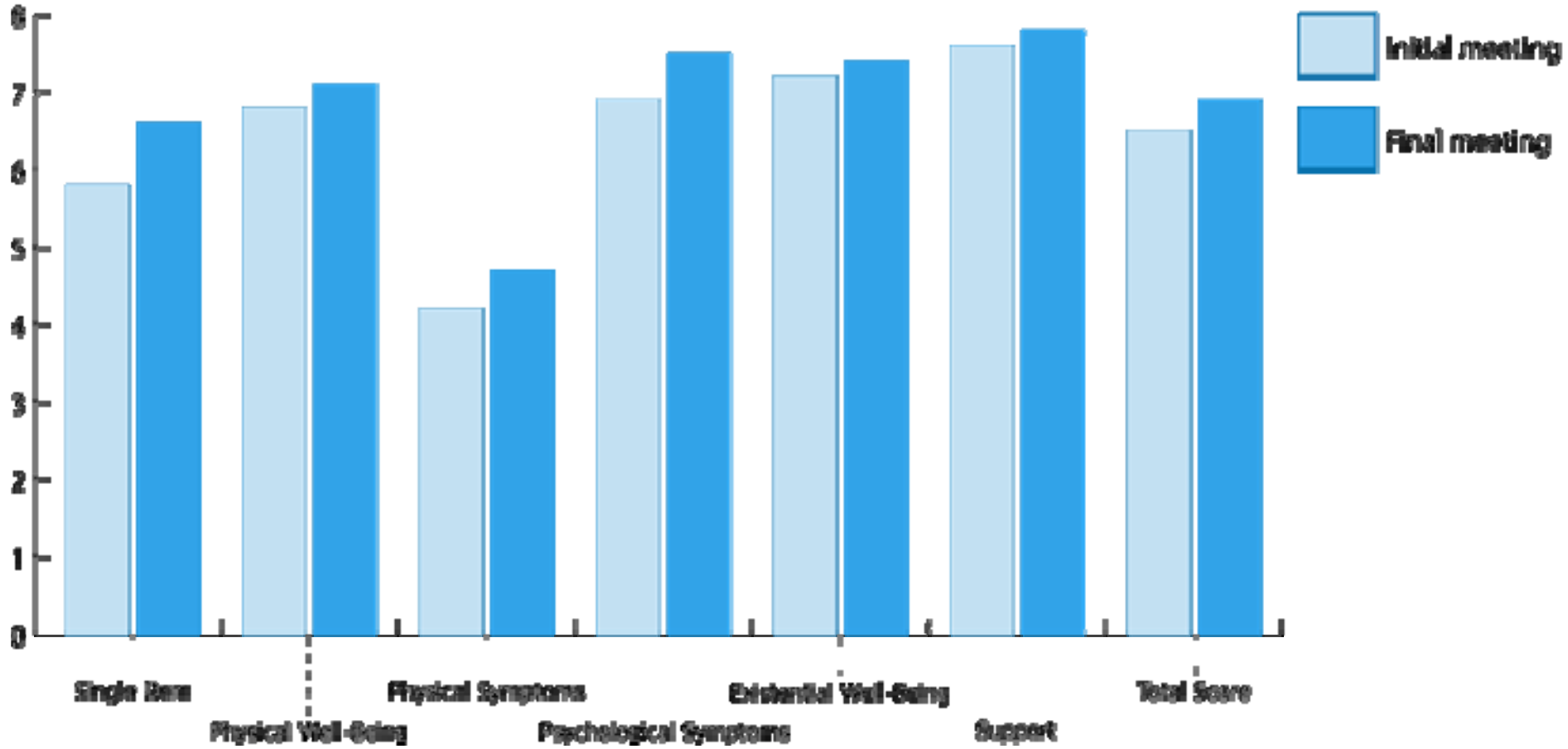
- Domenico is a young man, he lives with his wife
- He wants to try the ERICA system to speak with his 2-years old nephew
- ... and also to express his feelings with bad words
- When he tried ERICA finally he could speak with his nephew who could listen for the first time his “voice”

QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

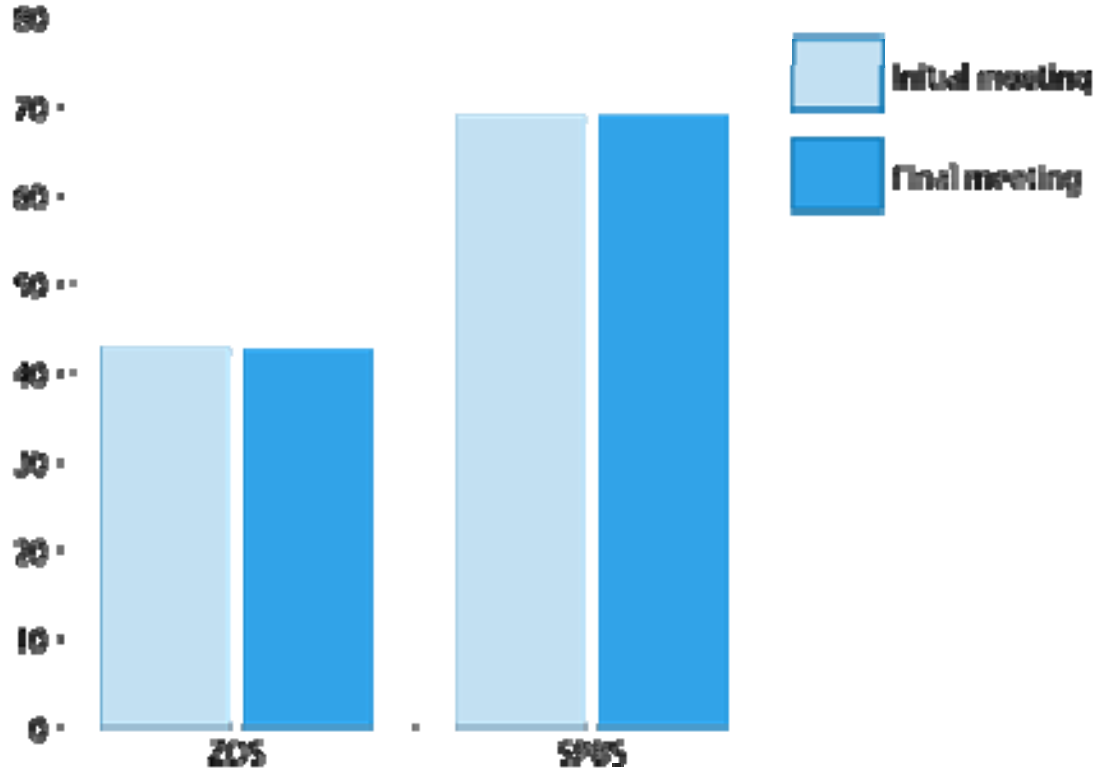
Quantitative results

Quality of Life (Mc Gill scale)

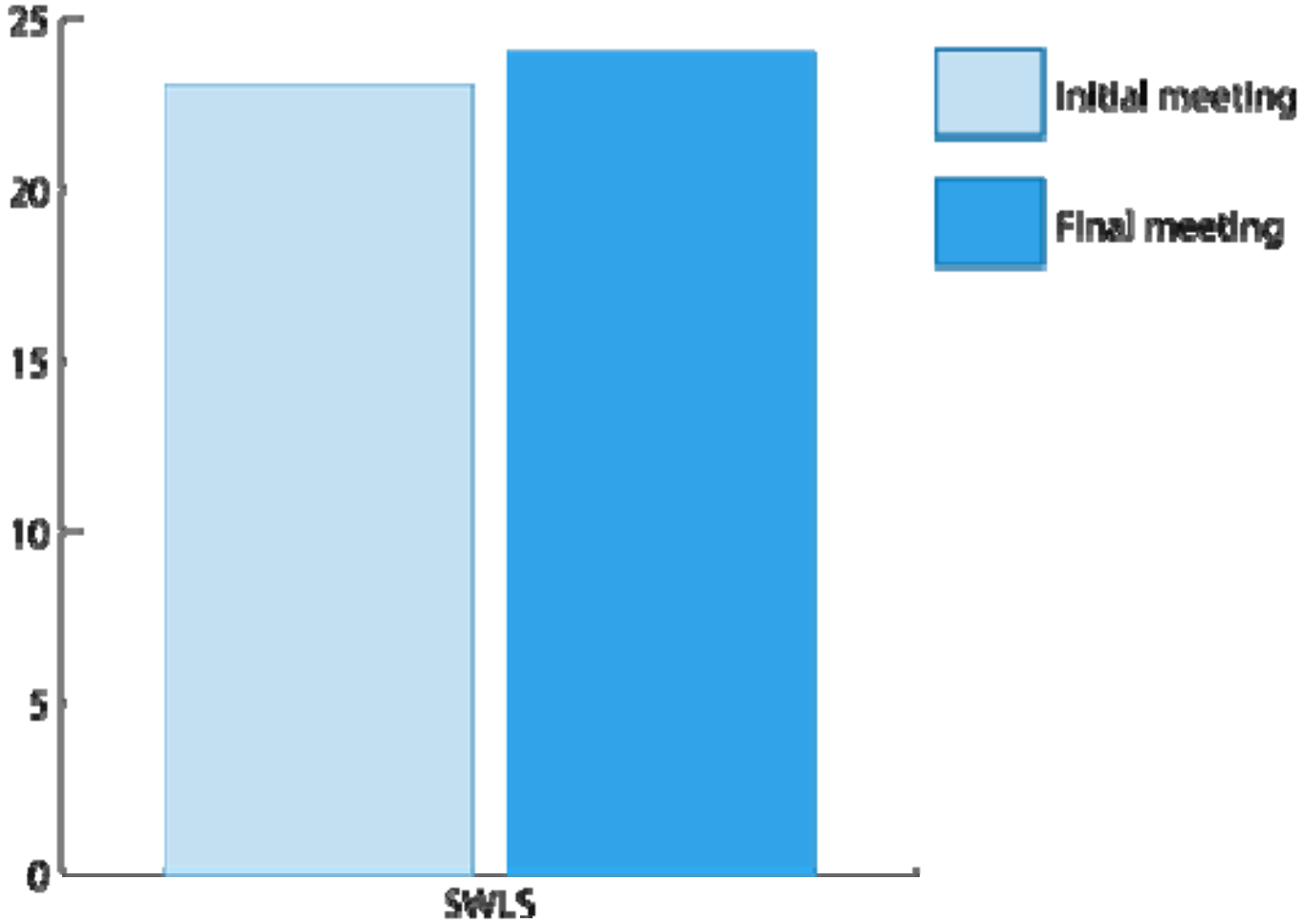


Depression and self-estimated burden

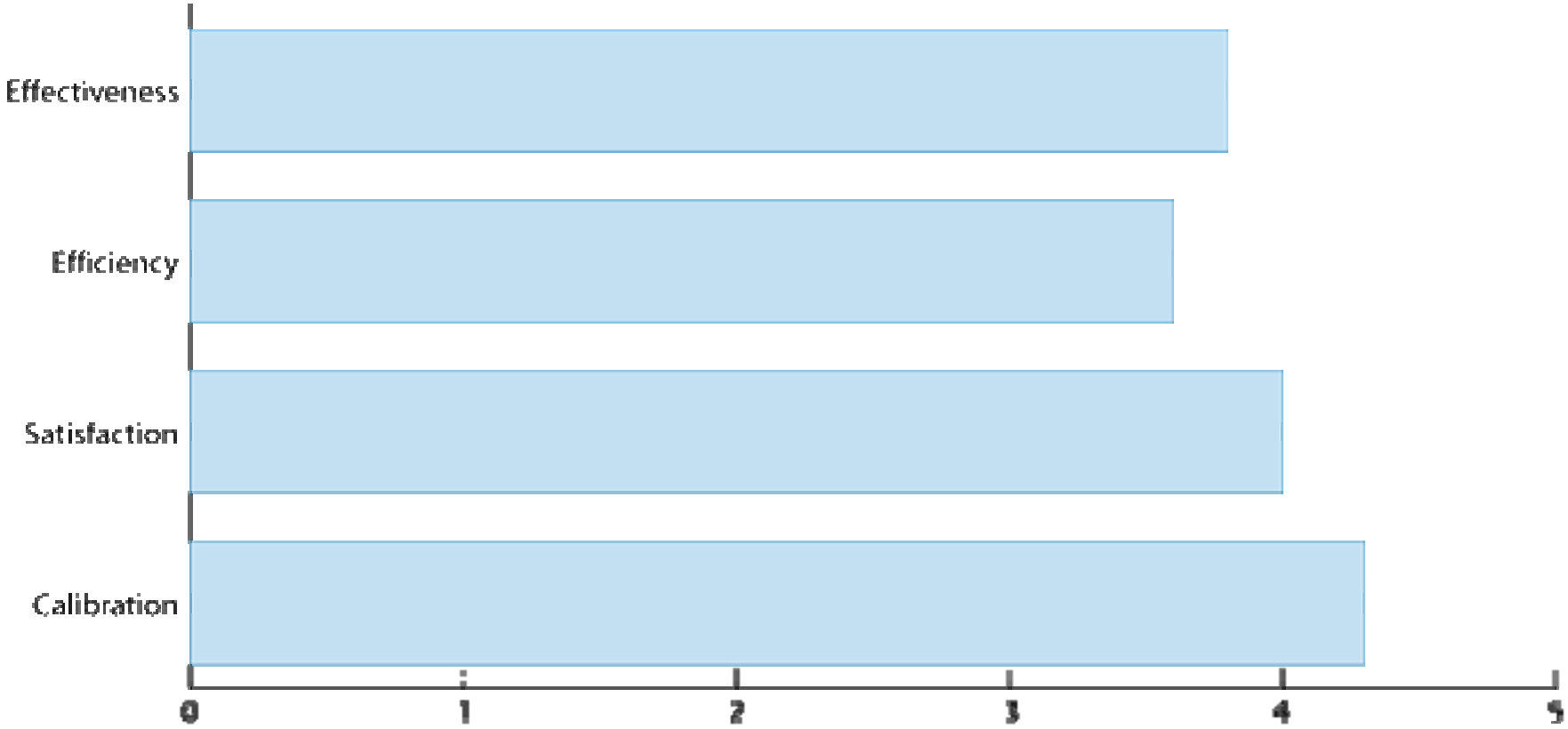
- There were no significant modifications on depression and burden scores



SWLS (satisfaction with life scale)



COGAIN questionnaire



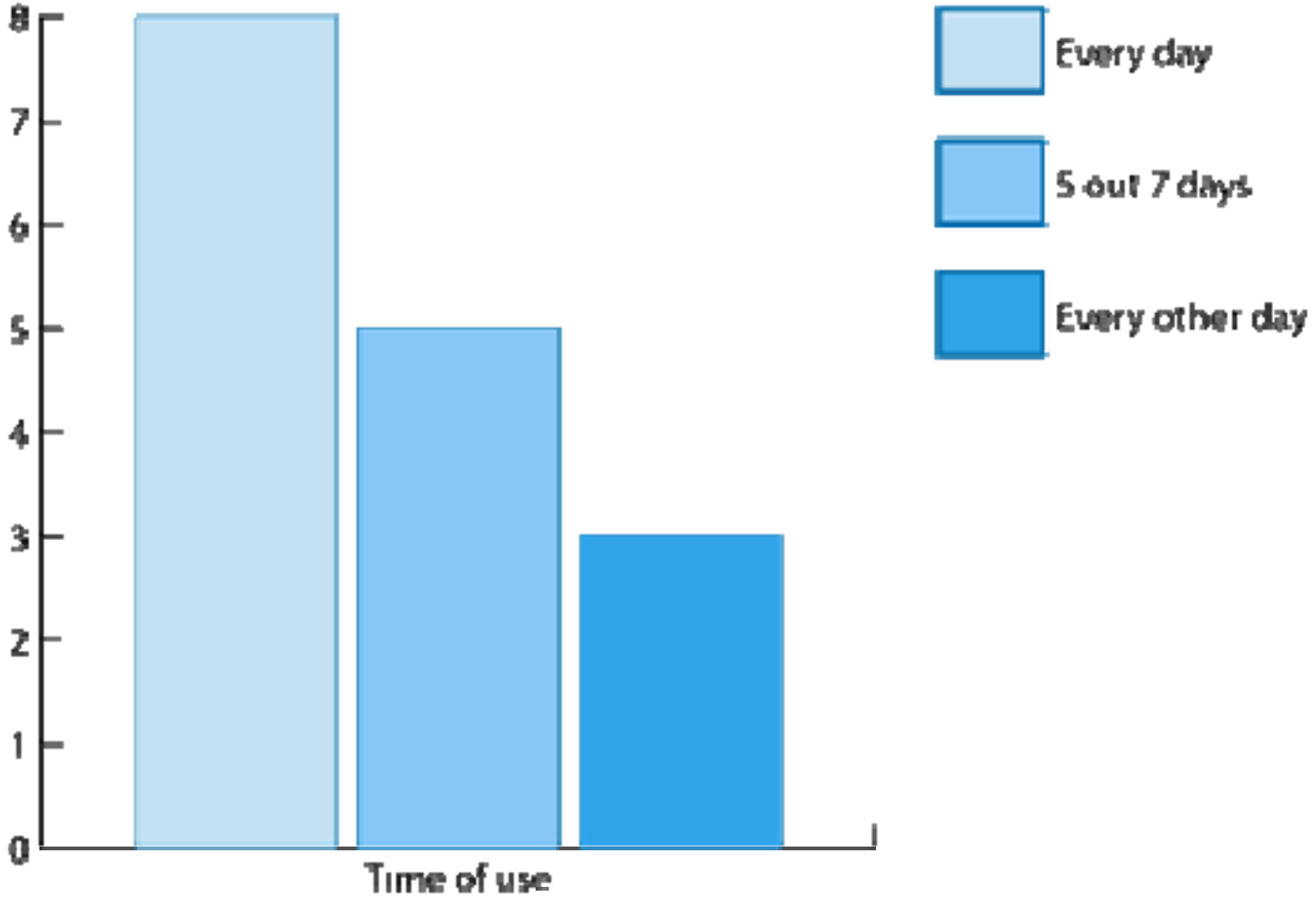
Patients feelings from the COGAIN questionnaire (1/2)

- Efficient and effective system, allows more complex communication, beyond the primary needs
- After calibration the user is independent in using applications (compared with Plexiglas tables)
- Users appreciated the dictionary for faster communication and the vocal synthesis

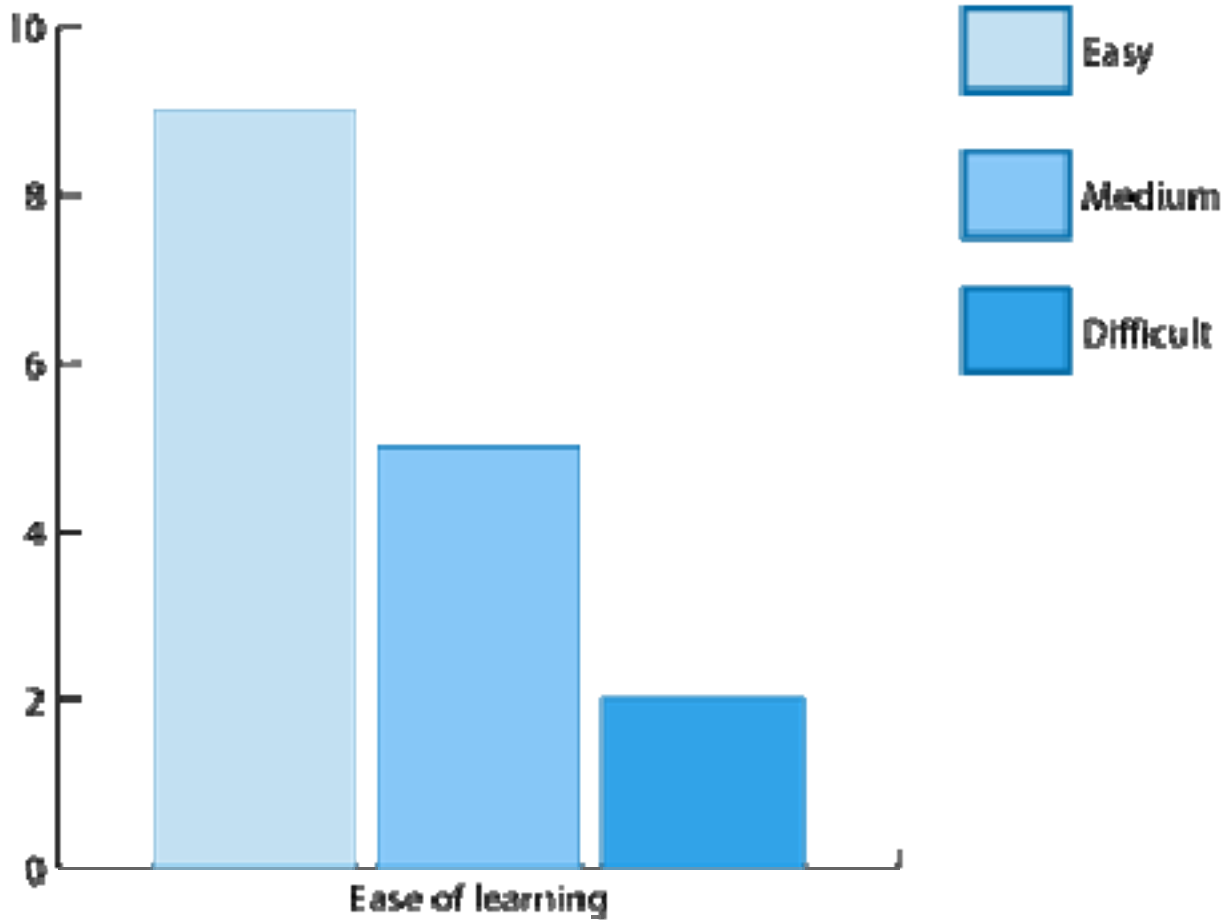
Patients feelings from the COGAIN questionnaire (2/2)

- Difficulties in the calibration procedure, and this caused weariness and frustration before using the system
- Suggestions expressed by the patients
  - A device for maintaining the head in the correct position
  - Software for phone communication

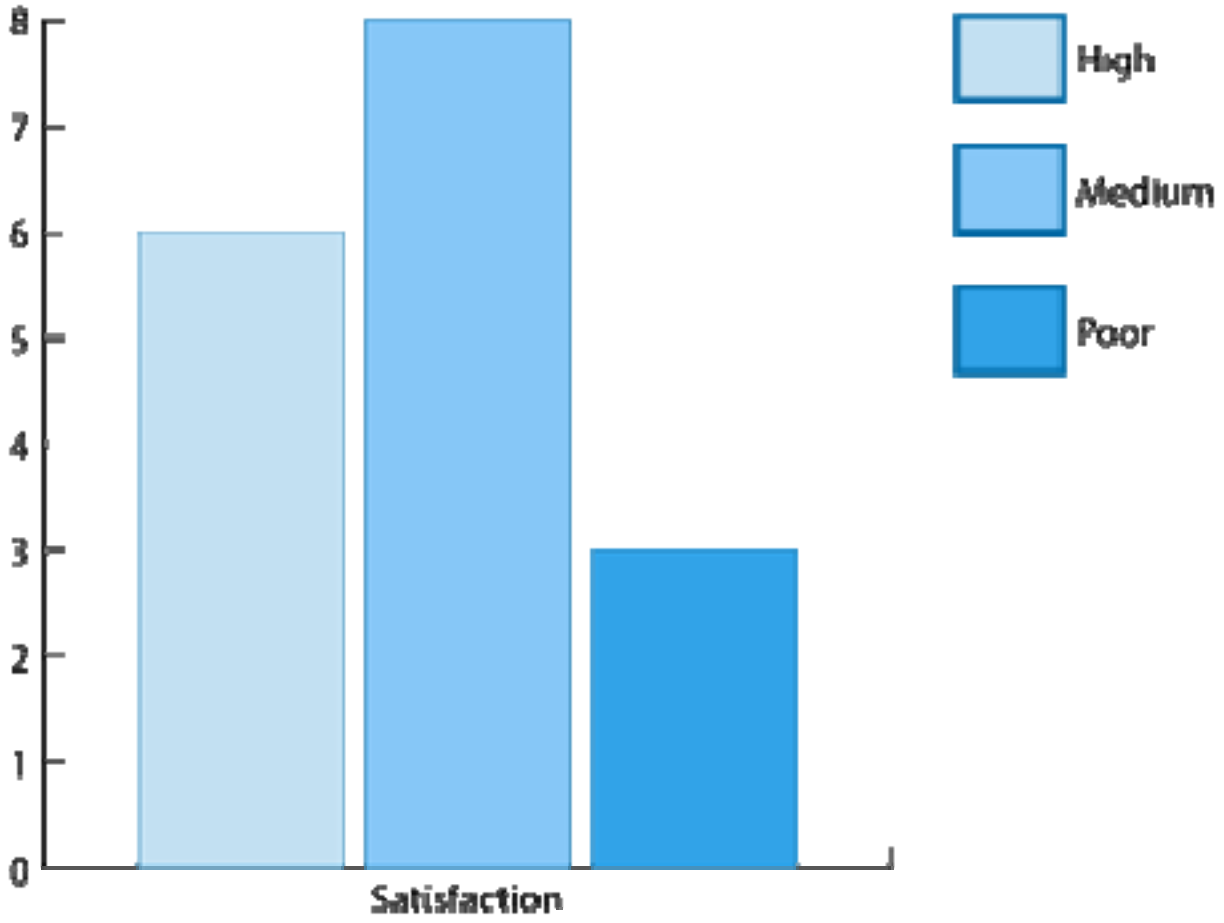
Patients feelings: the Torino ALS center questionnaire (1/4)



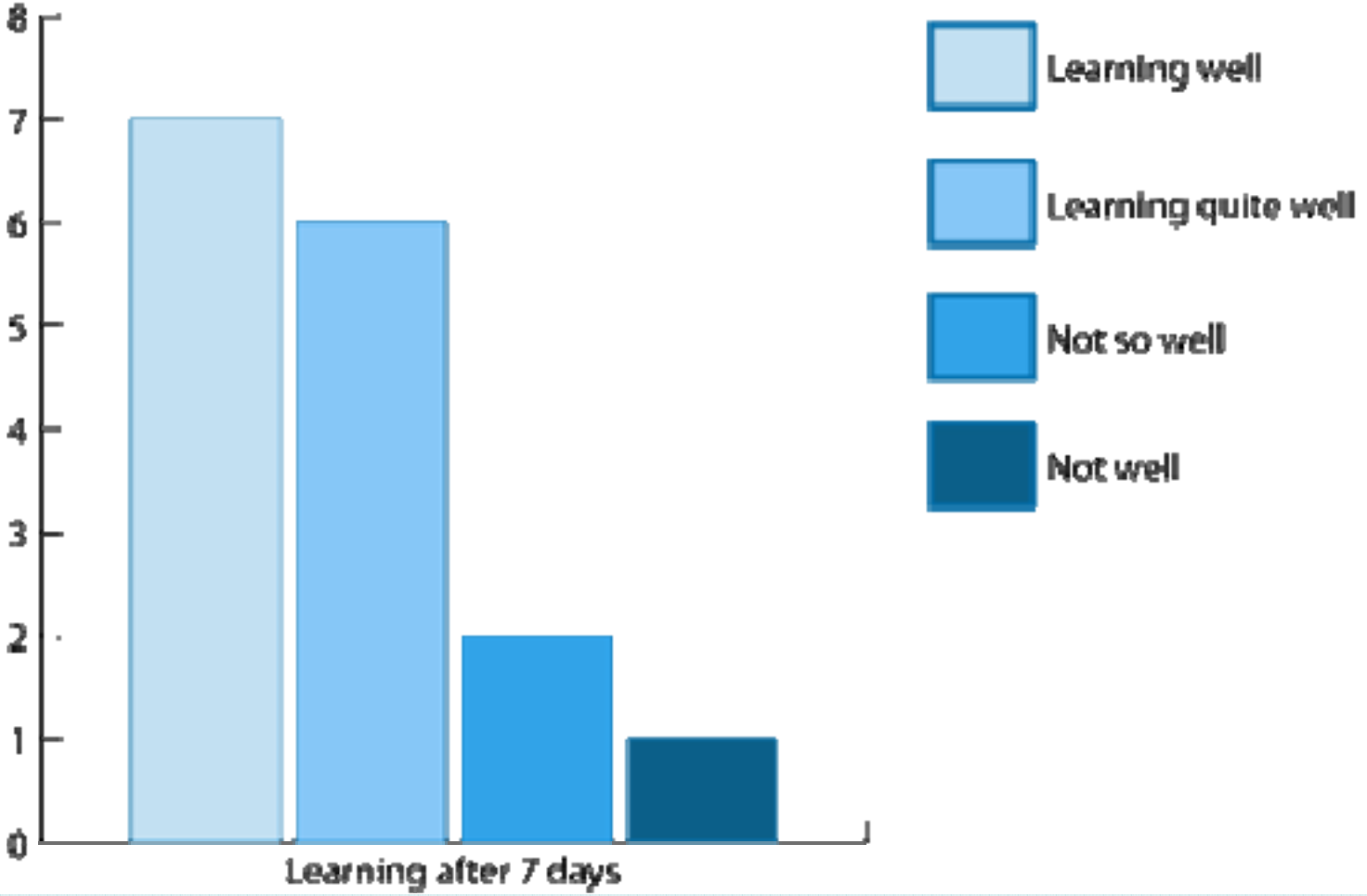
Patients feelings: the Torino ALS center questionnaire (2/4)



Patients feelings: the Torino ALS center questionnaire (3/4)



Patients feelings: the Torino ALS center questionnaire (4/4)



QoL impact for ALS patients

COGAIN
Communication by Gaze Interaction

Conclusions

Conclusions

- The Erica system was generally well accepted and considered easy enough to be used by ALS patients with severe disability
  - No correlation with caregiver's motivations or patient's motivations
- Better acceptance from patients with worse clinical conditions
  - Eye tracking benefits are lower for patients with residual arm mobility

Interesting findings

- Tracheomized patients had stronger motivation
- Due to two reasons
  - Anarthria represents the first motivation for communicating
  - Tracheotomized patients have better ventilation, therefore higher brain oxygenation, than patients with dispnea

Local impact

- Many patients tried to ask Piemonte Regional Government for a grant to buy eye-tracking systems but they had a negative answer
- At least three patients found some associations that helped them raising money
  - Now, these three patients regularly use an eye-tracking system for communication

Future perspectives

- Continuation of the experimental quality of life studies
- Analysis of work opportunities for ALS patients and spreading of the findings through associations and authorities
- Actions towards Piemonte Regional Government for political decisions concerning grants for eye tracking equipment

COGAIN Eye Control Hints and Tips

- This presentation is part of the COGAIN Eye Control Hints and Tips packet
- For more information, visit
- www.cogain.org