“Age Sensitive **ICT** Systems for **Intelligible City For All”**

I’CityForAll

AAL 2011-4-056

www.icityforall.eu

2012-2015

Coordinated by CEA

AAL
AMBIENT ASSISTED LIVING

CALL 4 ICT-based solutions for advancement of older persons' mobility

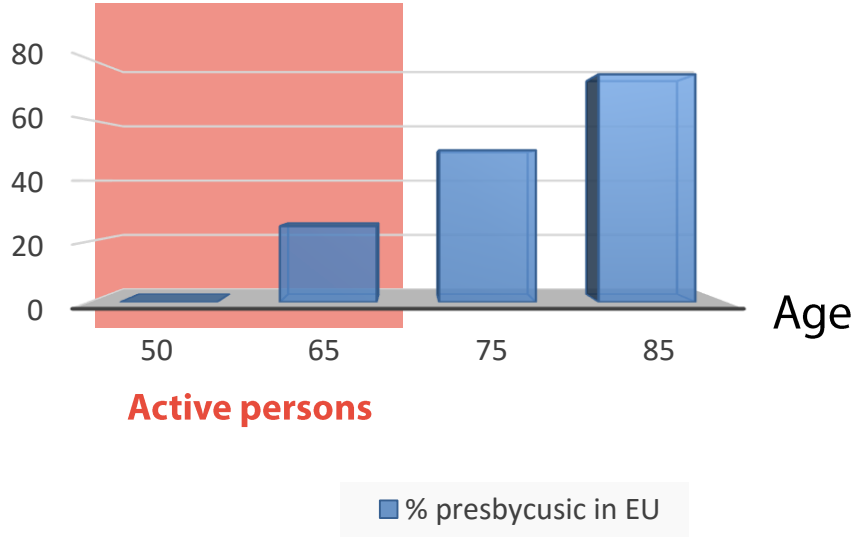
Europe- National Agencies' program to help older persons to sustain their optimal level of mobility for as long as possible, as well as enhance their individual sense of confidence, autonomy, competence, security and safety.

Aims at ICT-based solutions to identified user needs:

- Time-to-market perspective of 2 to 3 years after end of the projet
- Realistic trial set-up at the end of the projet
- Proactive end-user involvement throughout the life of the projet

Starting point : Presbycusis is the 3rd impairment of the elderly after arthritis & hypertension before presbyopia

"Presbycusis: Hearing impairment of older persons impacting the **intelligibility perception** and the **ability to localize sound source** and therefore physical and social well being"



Hearing-impaired persons

- **14%** only **wear hearing aids**
- **2/3** do not think or **refuse hearing-aids**

Two main situations

Mobility in public confined spaces

For better attractiveness/intelligibility/mobility in confined public spaces: Supermarket, railway stations, museum, theater, cinema...

Mobility in the urban space

To reduce urban-related accidents of elderly in urban settings: Elderly are involved in 40% of fatal injuries (105,000 deaths/year), by walking/car 1500/day accidents requiring medical assistance

ICT solutions: "Bring back normal hearing experience to presbyacusic elderly"

I'CityForAll consortium

End users field trials

- Psycho-sociology ORL

CENTICH
Centre d'Expertise National des Technologies de l'Information et de la Communication pour l'autonomie

- In Architectural and Urban Ambiances

- With ENEA subcontractor

ESCOOP

Solutions

- ICT-solutions

TUM Technische Universität München

ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

PARIS DESCARTES
Lipade

cea List

- Acoustic quality

EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

- With subcontractors

cea LinkLab Tunisie

TELNET Holding

- Audio expertise |Prototypes

U2S

Age Sensitive Users – Products

ICity – Car

Individual cars, professional vehicles, individual public transport

FIAT CRF CENTRO RICERCHE FIAT

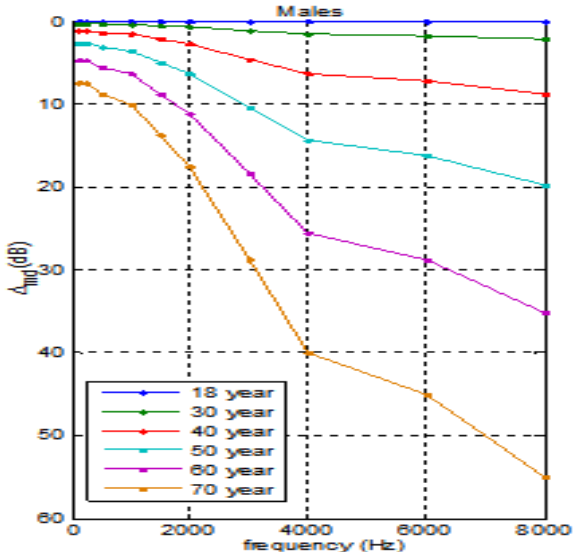
ICity - Loudspeaker

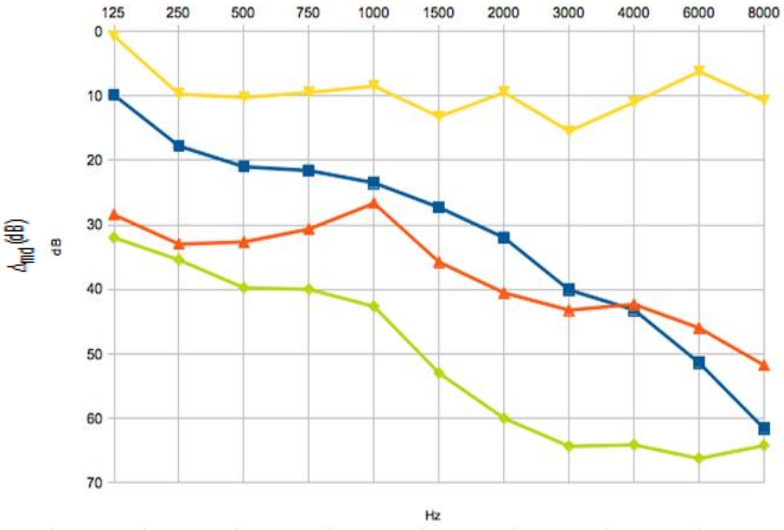
In railway station, airport, museum, supermarket

Active audio
L'acoustique active

Surveys for Mobility in public confined spaces and in the urban space

Age related hearing loss:
(Example Male losses)
ISO 7029





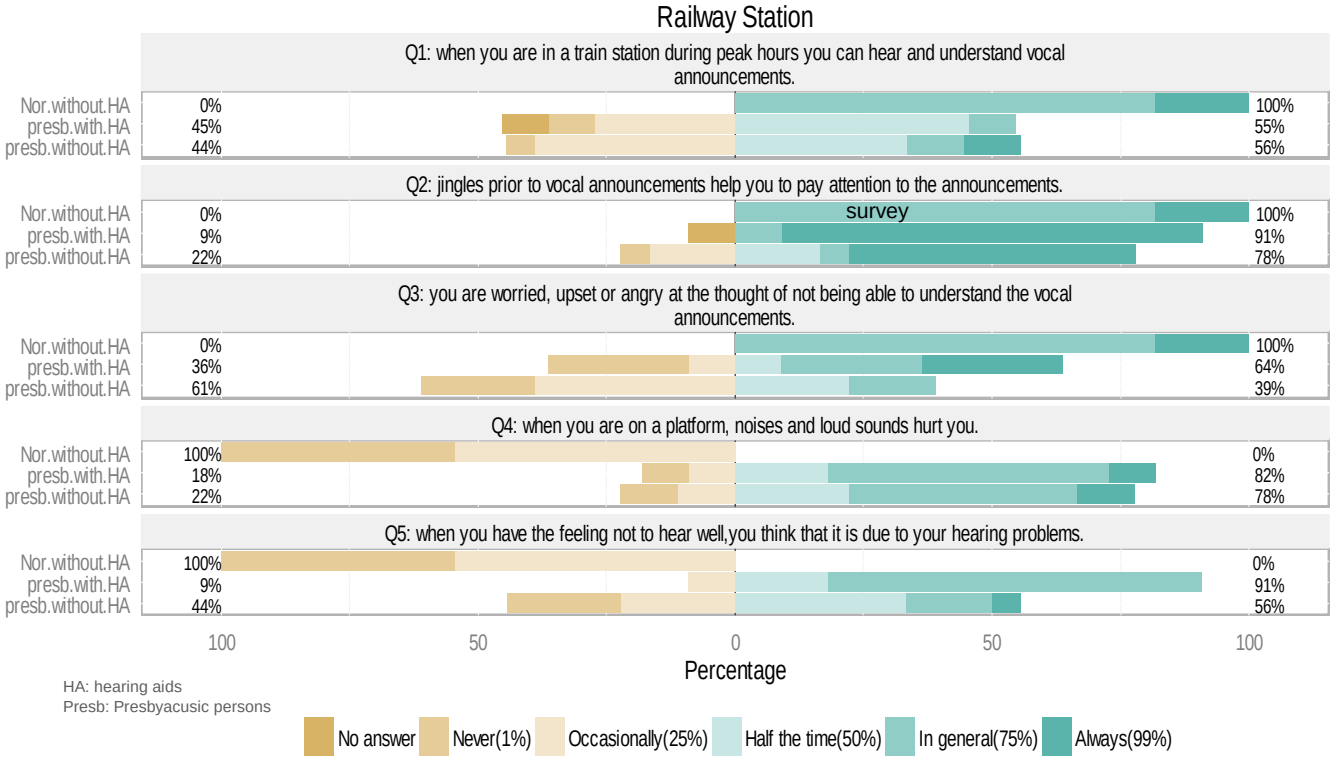
Average cohort audiograms

Cohort of the I'City survey
older than 50 years

Survey population: 38 persons*
50% Male, 50% Female.
20% Normal hearing.
30% Presby with hearing aid.
50% Persby without hearing aid.

*Centich-France & Escoop-Italy 2013

Surveys for Mobility in public confined spaces



- Intelligibility **decreases** for **all Presb.** at **peak hours**
- **Jingles** help **paying attention** to the vocal announces **for all**
- Feeling of **stress and discomfort** is **more** noticeable for **Normal hearing**
- Preb. are the **most hurt by loud sounds** and **noise**
- **Presb. with HA** are **more aware** about their problems **than without HA**

I'City solutions

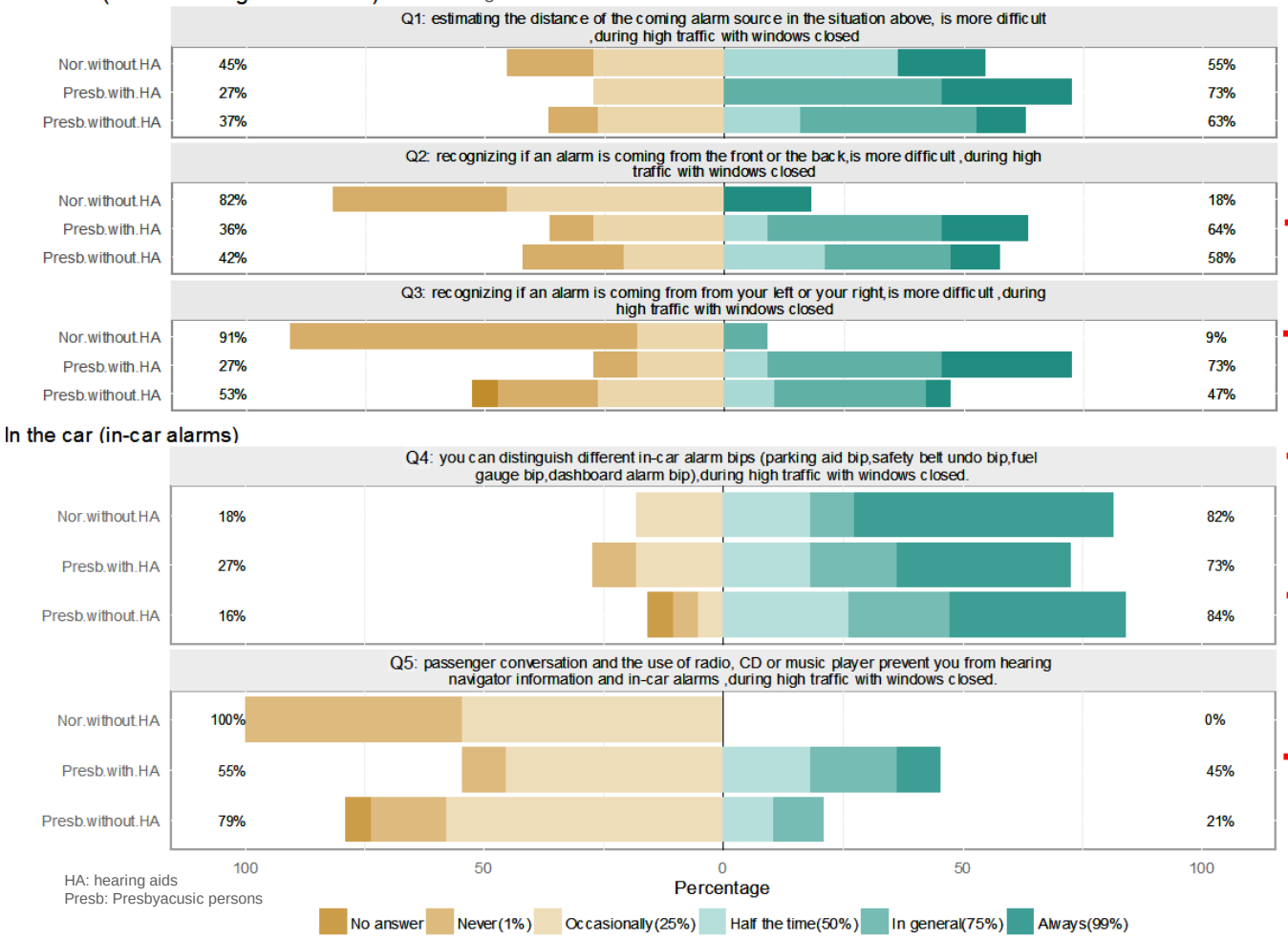
Smart Loudspeaker in public confined spaces

For **better intelligibility** of vocal messages and jingles for all

Products : PERCEIVALL, SpeechConformer, SIM*for*ALL

Surveys for Mobility in the urban space

In the car (alarms coming from outside) : case of high traffic with closed windows



All persons **have difficulties** to estimate alarm **distance estimation, with higher frequency** for **Presb. with HA**.

Front/back and left/right confusion is a common difficulty for **Presb.**
For **left/right localization, Presb-HA** have more difficulty to localize the alarm source than **Presb. without HA**.

During **high traffic, All** persons have few difficulties to distinguish the different **in-car alarms.**

Presb. have **difficulties** to hear **in-car alarms** or on-board navigator in noisy environment. This occurs occasionally for Normal hearing and more often for Presb. in particular with HA.

I'City solutions

Smart loudspeaker for vehicles for **better localization of alarm** sounds*
and an appropriate **enhancement of in-car alarms****

Products : PERCEIVALL, AlarmSniffer

*e.g. ambulances, police cars
**e.g. safety belt warning, lane change warning

Lack of intelligibility of vocal announces & Confusion in localizing alarm sources affect differently Normal and Presbycusic

The survey confirms that "For All" solutions are necessary for better intelligibility in public confined spaces and better localization in the urban space

“Intelligibility” Objective

I’City – Loudspeaker in public confined spaces for better intelligibility of vocal messages and jingles

I'City – Loudspeaker for better intelligibility

In railway station, airport, museum, supermarket…

Speech Conformer

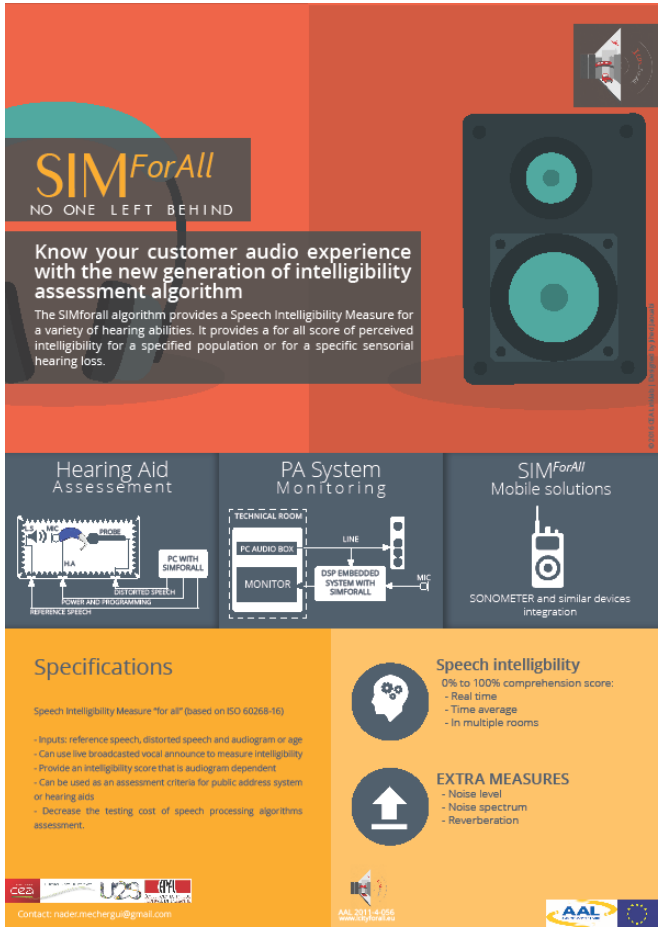
PerceivALL

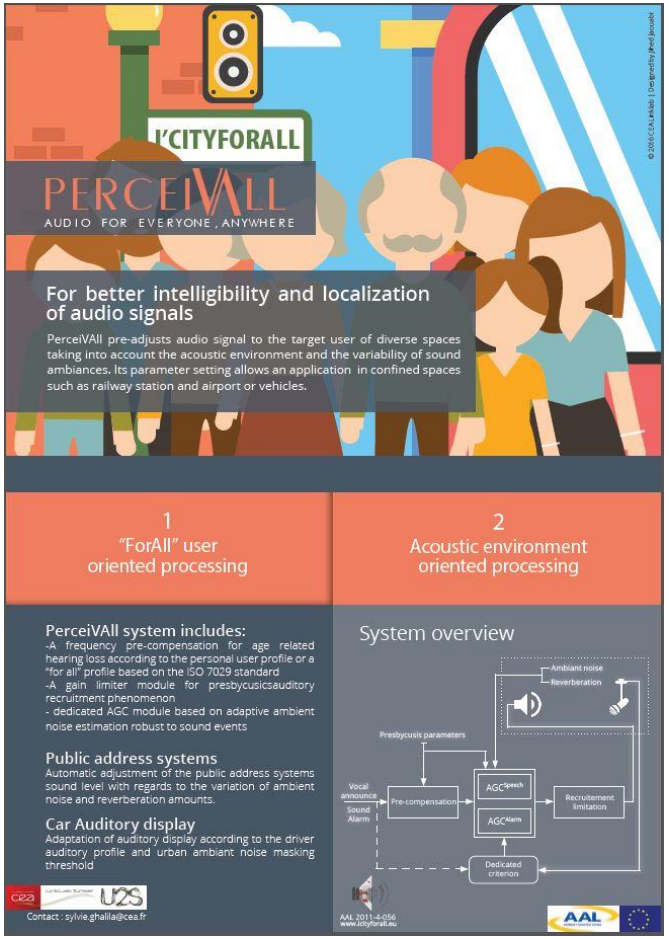
Digital Audio Processor

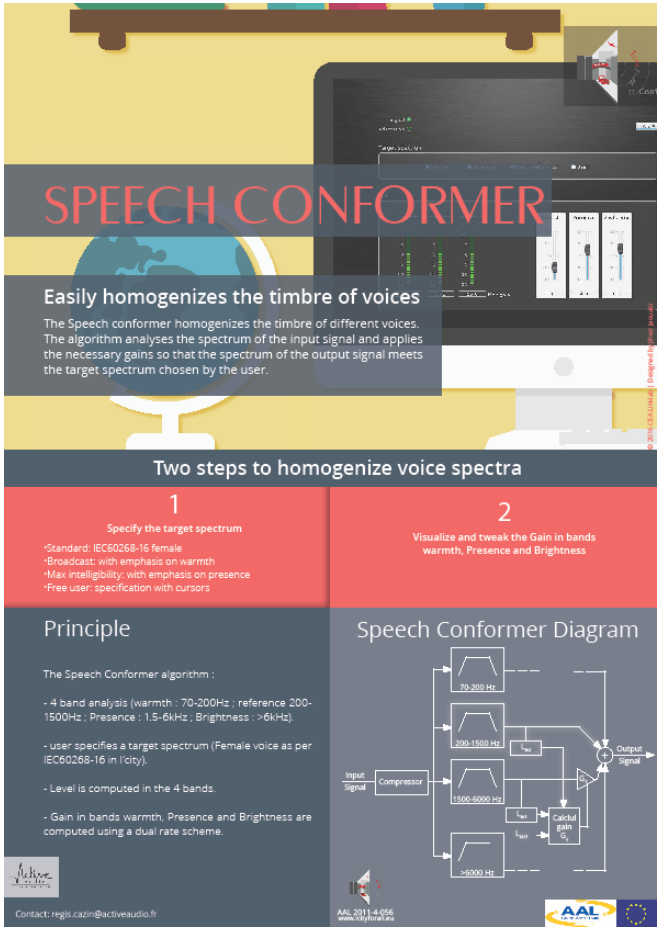
SIMforALL

I'City – Loudspeaker for better intelligibility

PRODUCTS







“Localization” Objective

I’City – Car in vehicles

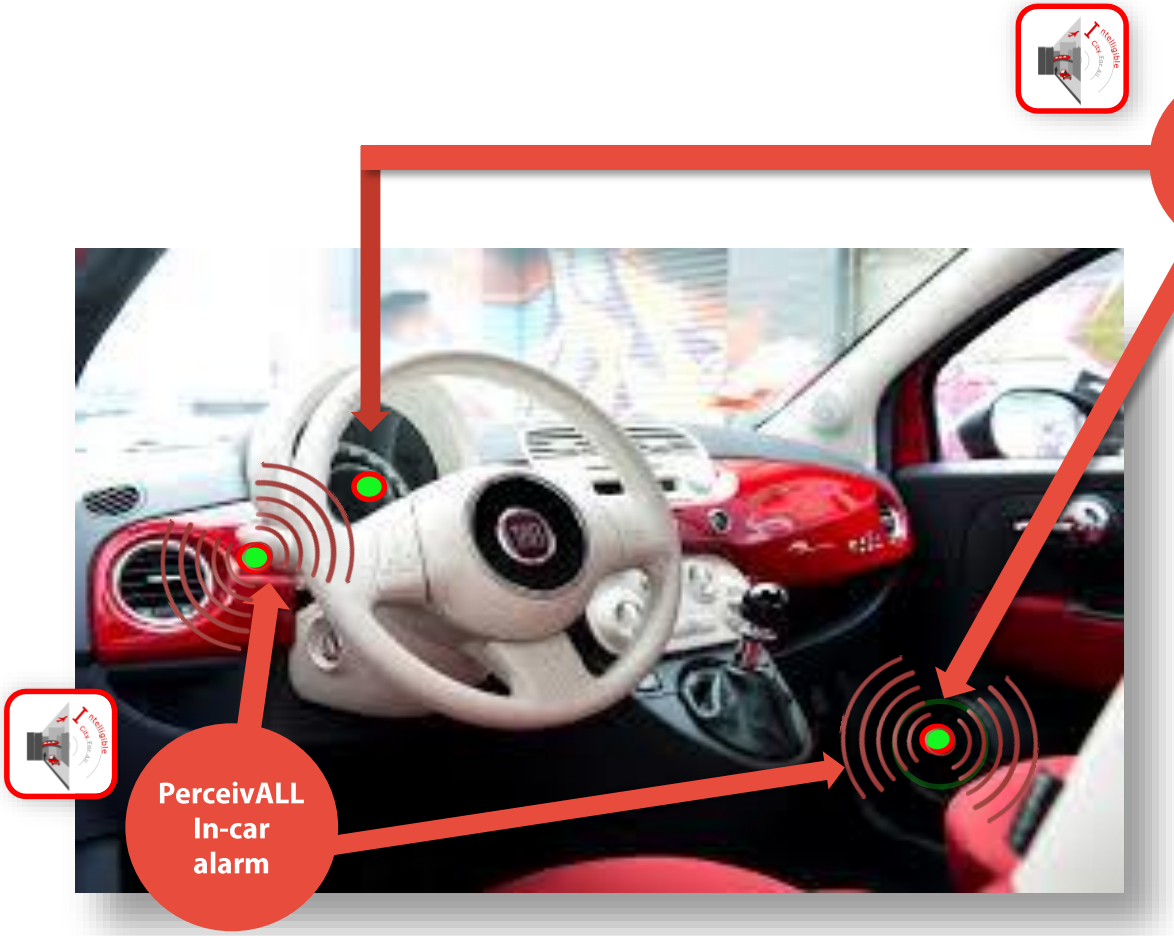
for **better localization of alarm** sounds

(e.g. ambulances, police cars)

and appropriate **enhancement of in-car alarms**

(e.g. safety belt warning, lane change warning)

I'City – Car for enhancing alarm localization



Audio-Visual HMI

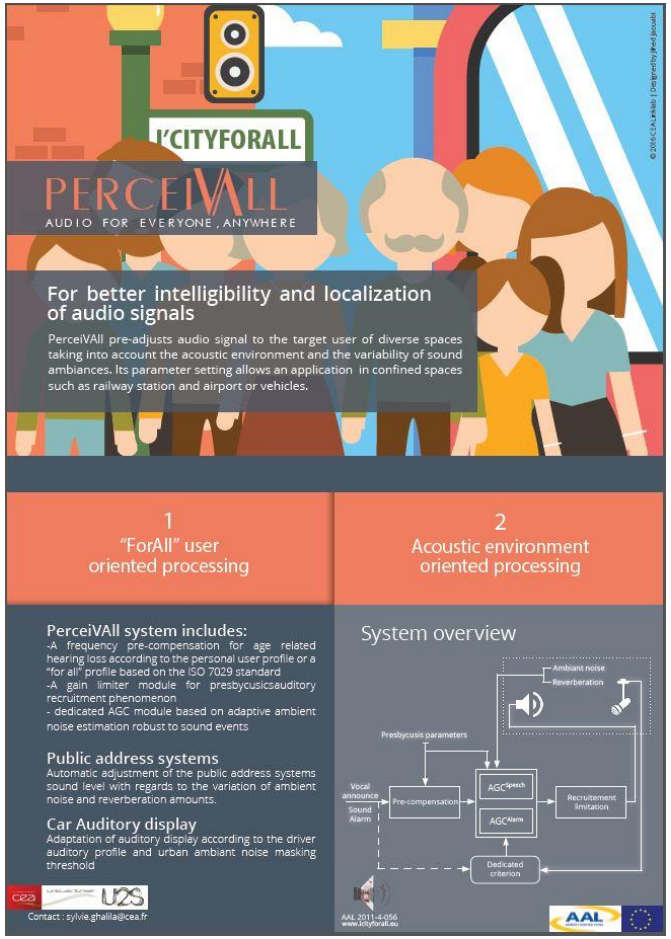
In **individual cars Professional vehicles**:

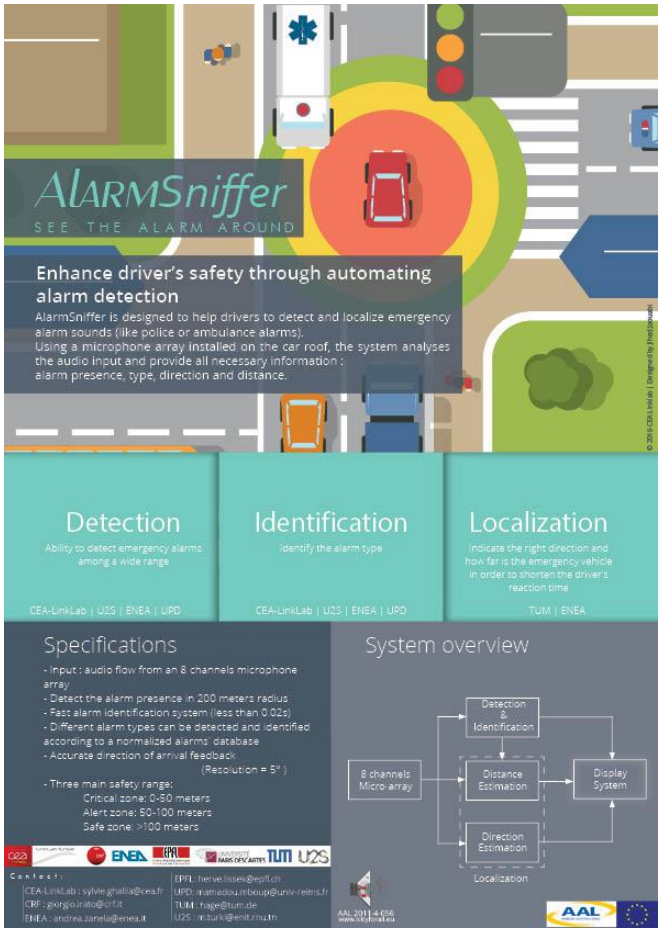
taxi bus, truck,…

for companies of **individual public transport**: autolib…

I'City – Car for enhancing alarm localization

PRODUCTS





End User Assessments

In car & in public space solutions

in lab & in vivo validation of I'City products

End User Assessments

Public space solutions

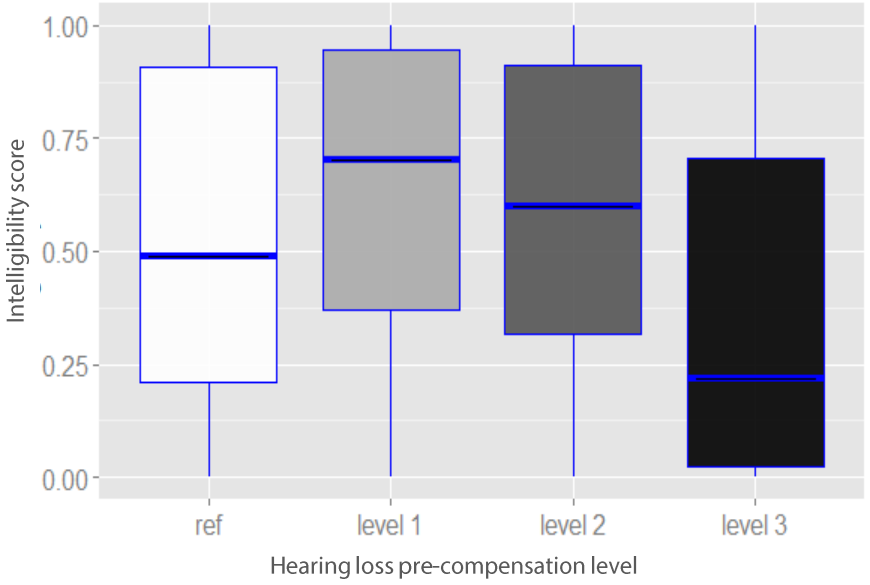
in lab & in vivo validation of I'City products

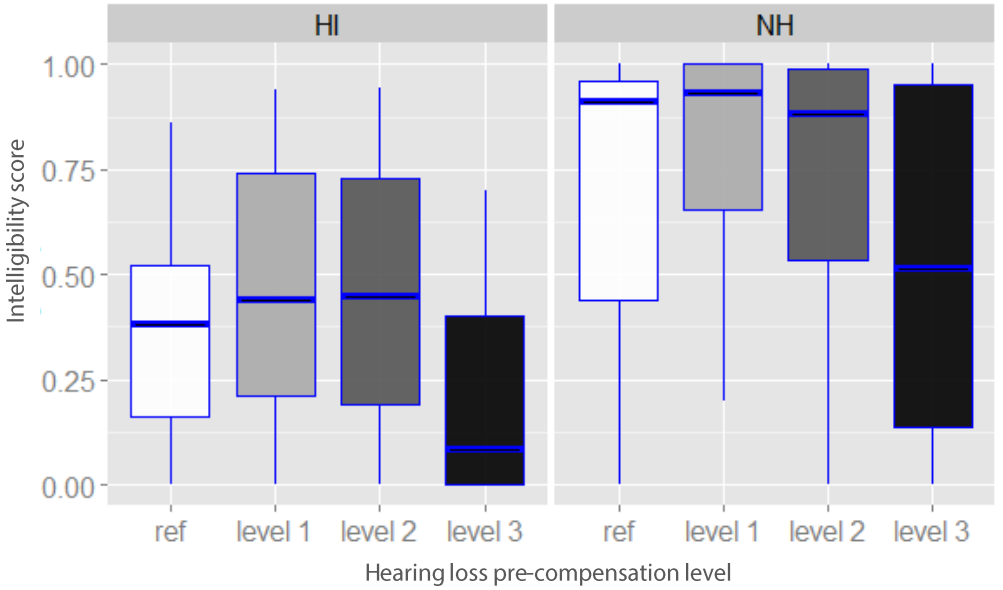
IN LAB

Mobility in public confined spaces

Pre-compensation module of PerceivALL

In lab tests at EPFL LEMA, 10 Normal Hearing, 10 Persbyacusic without hearing aid





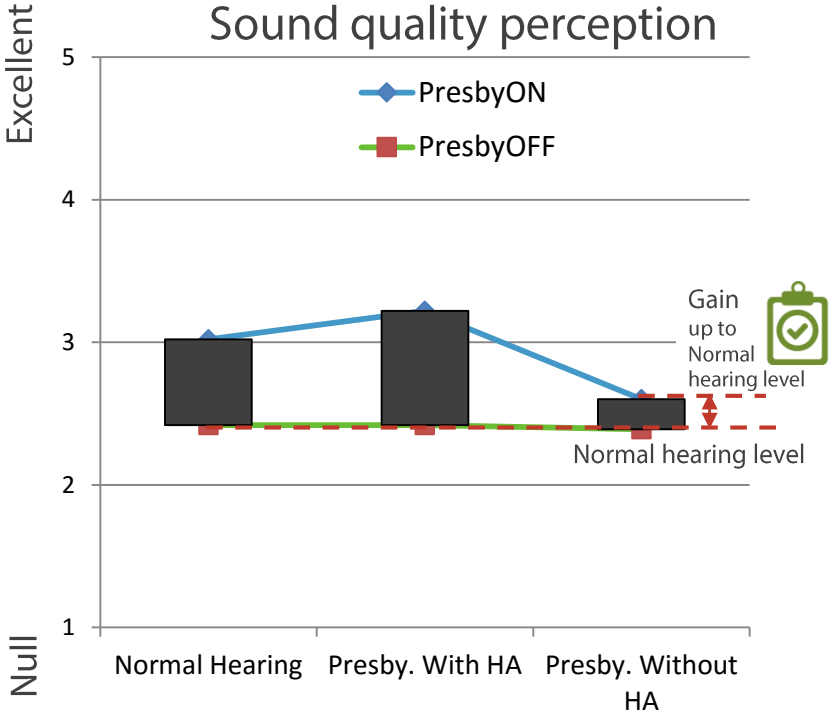
Without increasing the overall loudness of the vocal announcement,
Levels 1 and 2 of Perceivall pre-compensation enhance the intelligibility
for both normal and impaired hearing persons

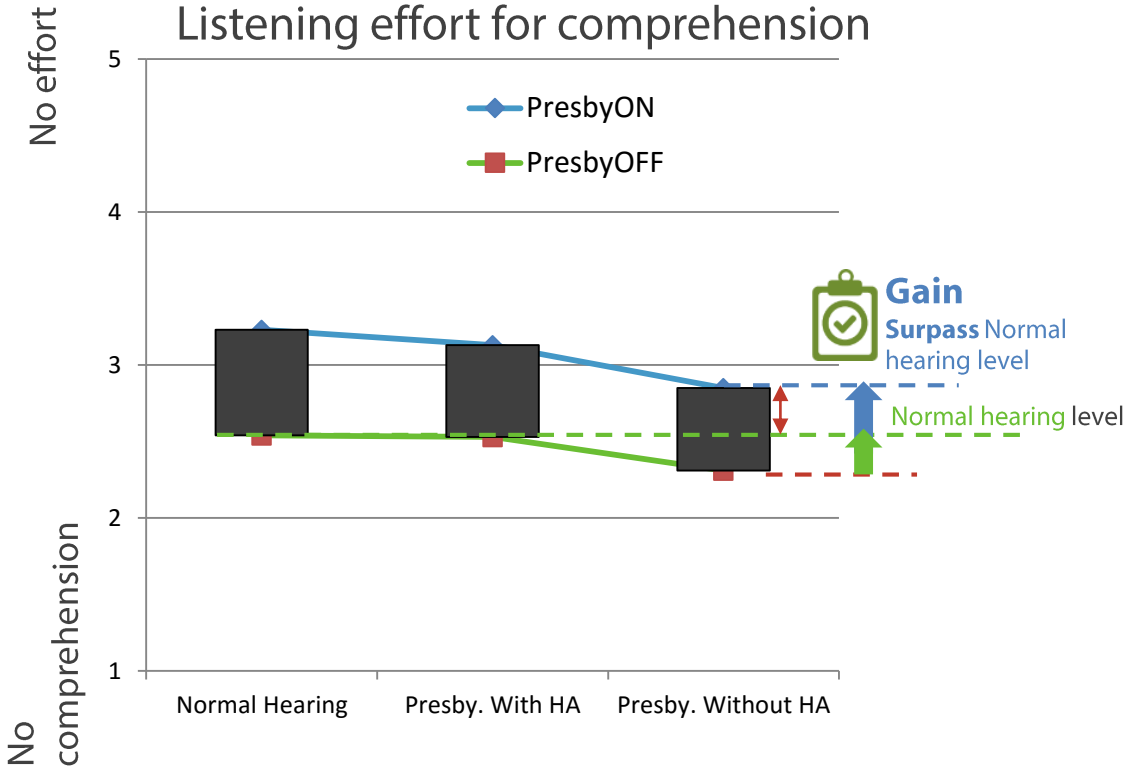
IN VIVO

Mobility in public confined spaces

Pre-compensation module of perceivALL

Foggia railway station Italy, 13 Normal Hearing, 15 Presbyacusic without hearing aid and 10 with hearing aid





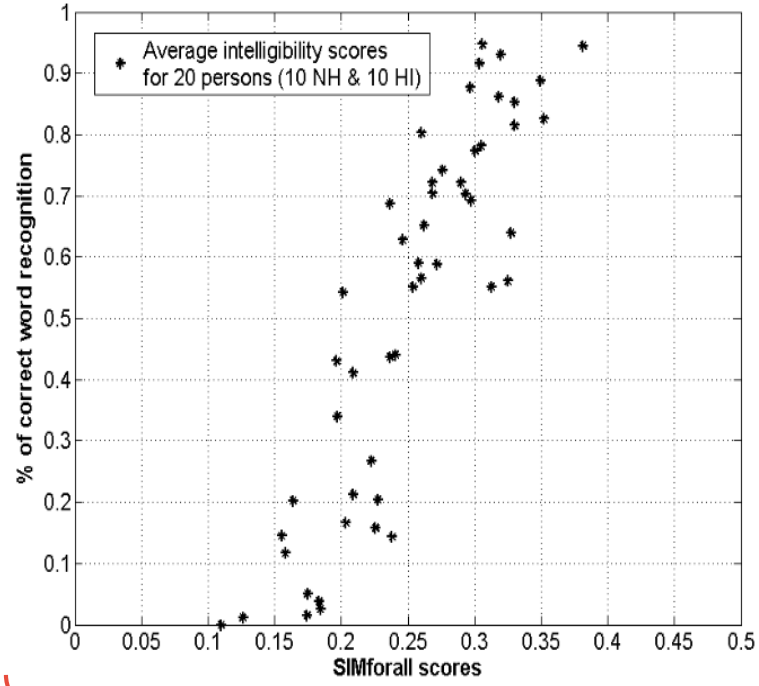
1 Raise intelligibility for Presbycusis to -at least- a normal hearing level

2 Better hearing for both normal and presbyacusic persons

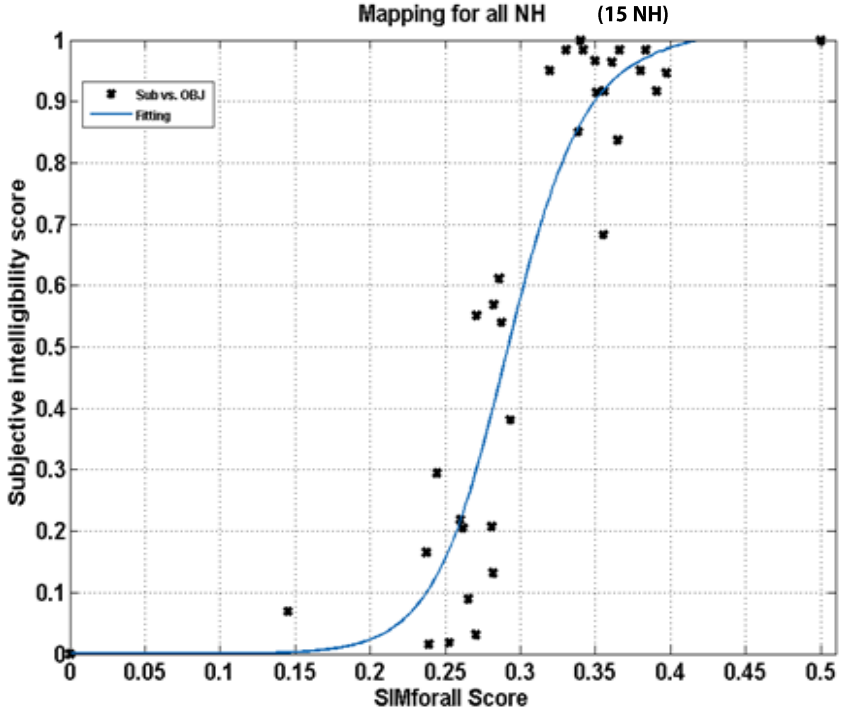
Mobility in public confined spaces

SIMforAll Objective intelligibility measurement tool

EPFL tests



ActiveAudio tests



- Presbycusic behavior is correctly modeled by the SIM*forAll* algorithm
- Good correlation between subjective and objective scores for NH, HI and "For All"

End User Assessments

In car solutions

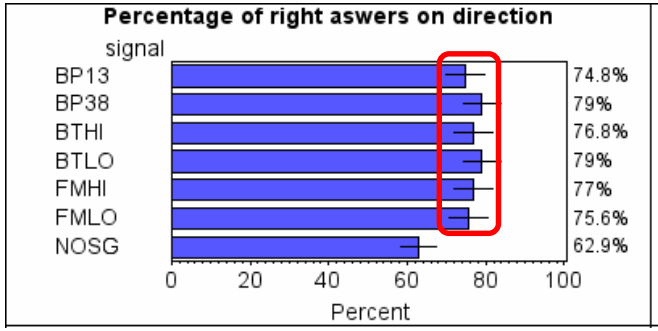
in lab & in vivo validation of I'City products

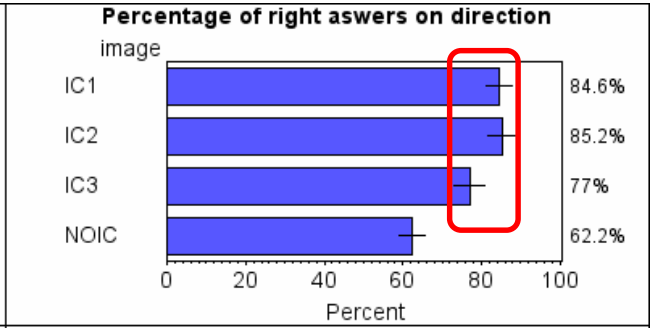
IN LAB

Mobility in the urban space Driver assessments

CRF in lab tests: HMI simulation using Perceivall as Auditory Display and AlarmSniffer visual module as Visual Display

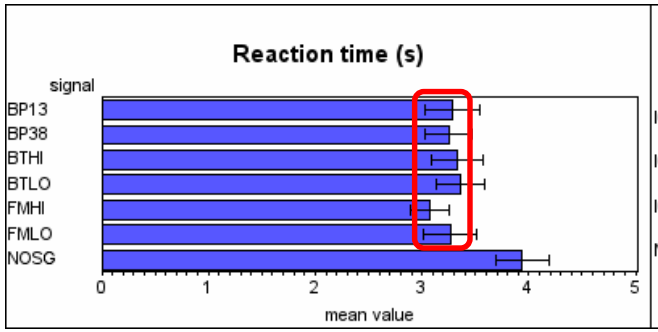
+12% (or more) improvement of right localization of DOA*

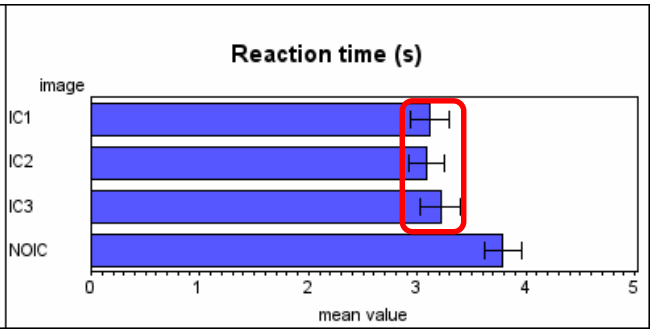




+15% (or more) improvement of right localization of DOA*

+15% (or more) improvement of reaction time





+18% (or more) improvement of reaction time

Audio and visual HMI
improve the "siren direction detection" ability and reduce reaction time

*DOA: Direction of arrival

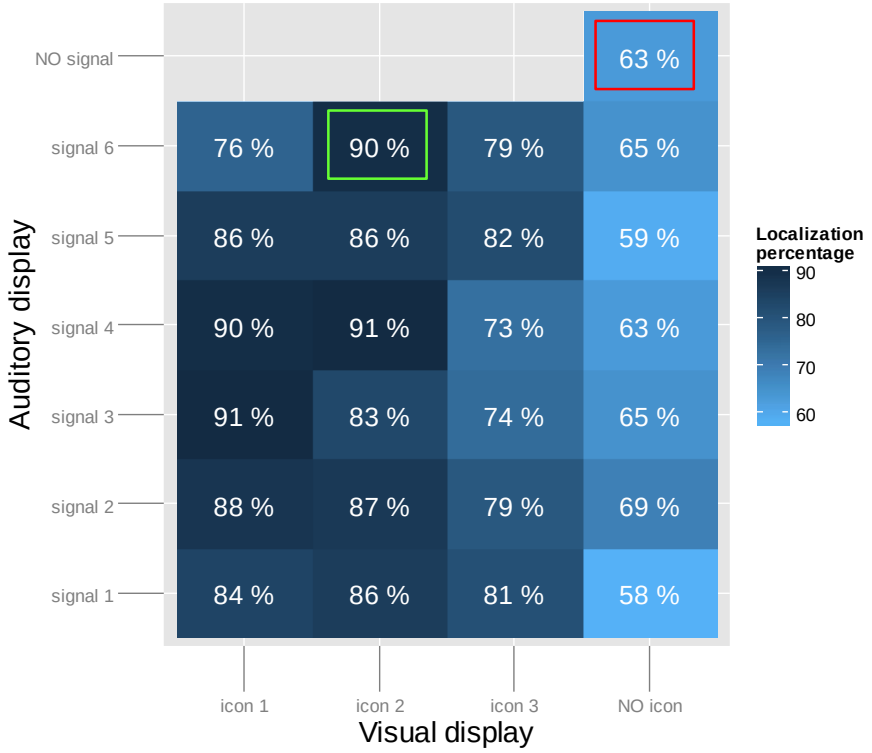
IN LAB

Mobility in the urban space Driver assessments

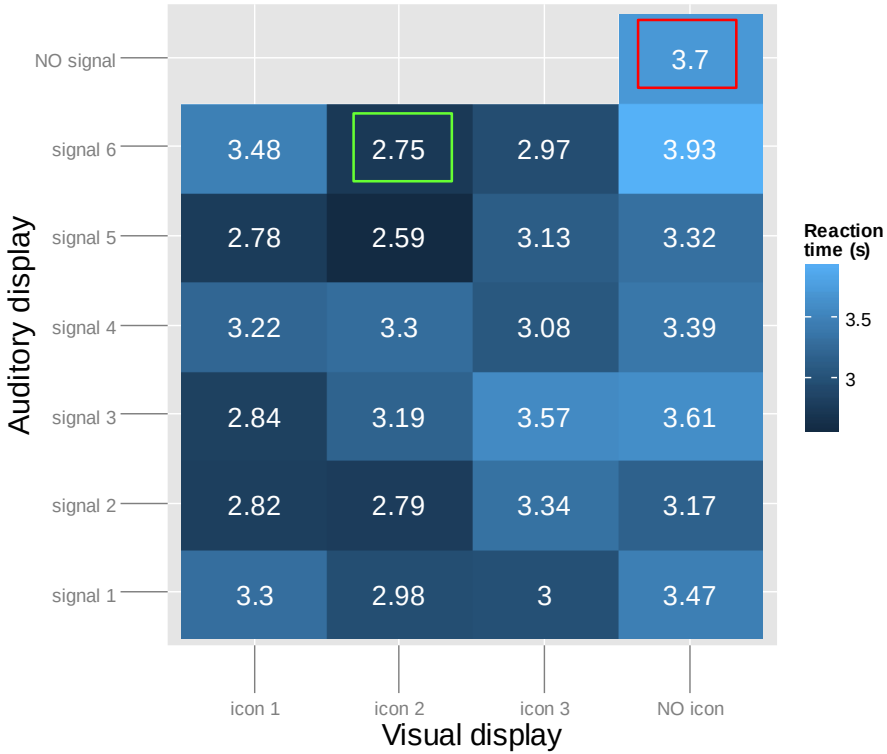
CRF in lab tests

40 people (1/3 females, 2/3 males), with ages ranging from 20 to 65, with normal hearing(*)

Percentage of sound localization of the DOA(**) of siren



Reaction time average for right localization of the DOA of siren



Up to 42 % increase of sound localization with 1s reduction in reaction time

*The effects of Presbycusis are simulated by appropriate processing of the sound signals into 4 groups of "virtual" hearing impairment: normal hearing and 3 levels of hearing loss

** Direction of arrival

IN VIVO

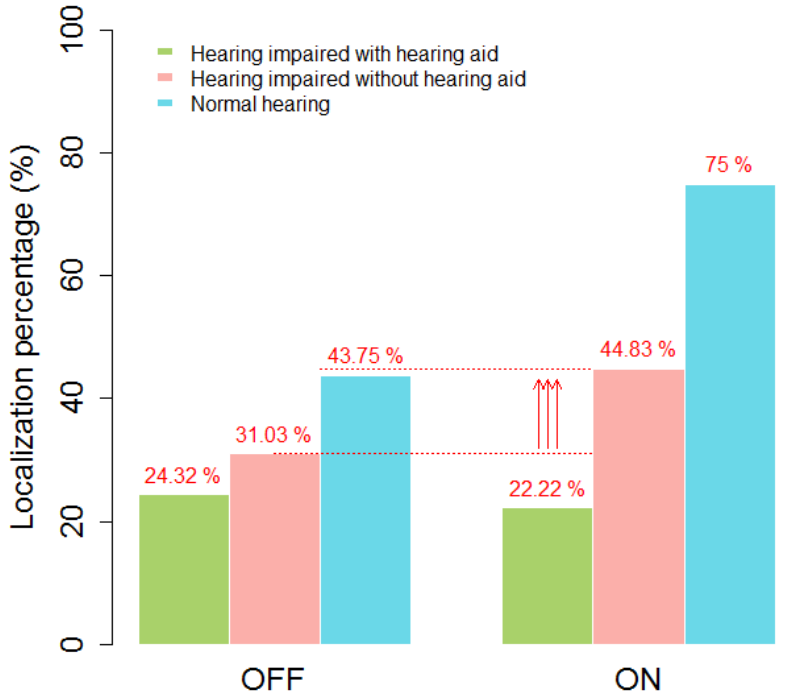
Mobility in the urban space Driver assessments

CENTICH *in vivo* tests

2 normal hearing drivers , 4 presbycusic drivers without hearing aid, 5 presbycusic driver with hearing aids

AlarmSniffer and Perceivall: Auditory display module

Percentage of localization of the direction of arrival of the external alarm:



I'CityForAll solutions improve the sound localization for drivers including presbycusis drivers

Thank you for your attention

Age Sensitive **ICT** Systems
for **Intelligible City For All**
I'CityForAll

AAL 2011-4-056

www.icityforall.eu

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