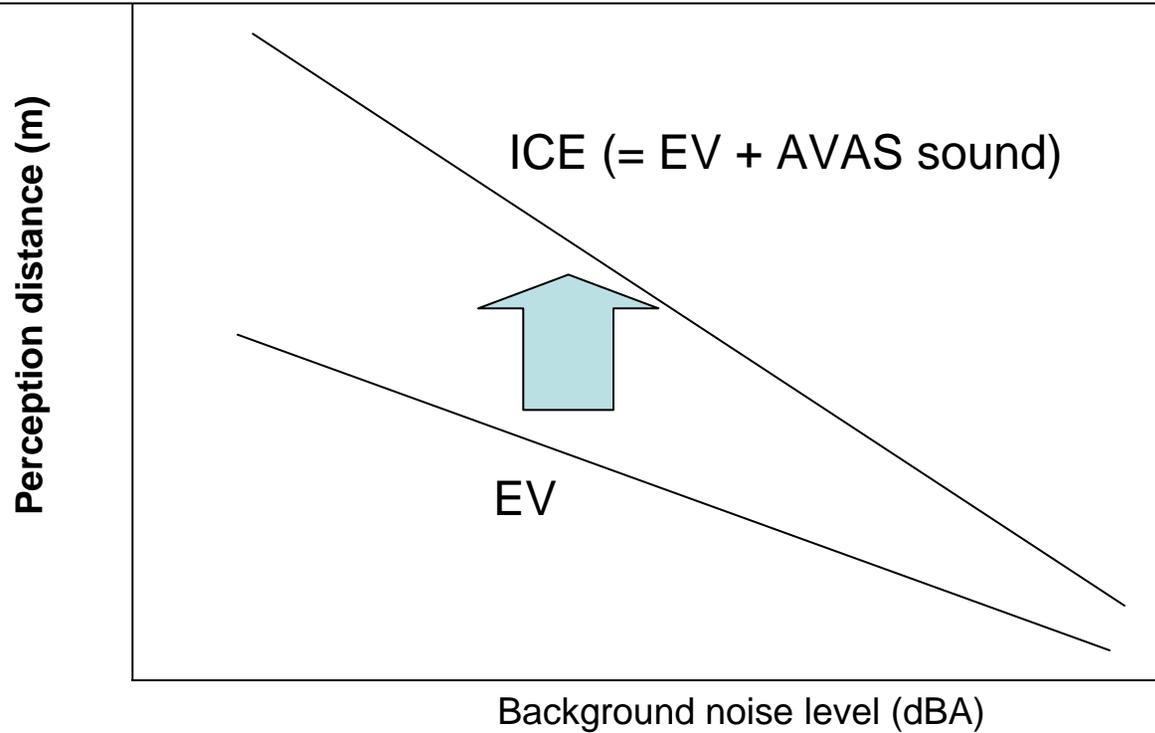


Optimumization of Sound Level for Approaching Vehicle Audible System

JASIC, JAPAN

Relation between Background Noise Level and Perception Distance for Vehicles Approaching at Steady Speeds



* Higher the background noise level, shorter the perception distance.

* Higher the warning sound level, longer the perception distance. This is good but raises concerns about its effect on environment.



To determine AVAS sound level, we need to consider the following:

- 1. Considerable background noise range (max. background noise level that should be taken into account)**
- 2. Perception distance to be required (max. distance where the warning sound should be heard)**

Considerable Background Noise Range

* The result of a 2007 survey on pedestrians' judgment using 3 levels of background noise (20 subjects: 10 males and 10 females aged 22-58)

Recording ground noise (3 levels)



A residential area
(Corresponding UNOG at 52nd GRB)



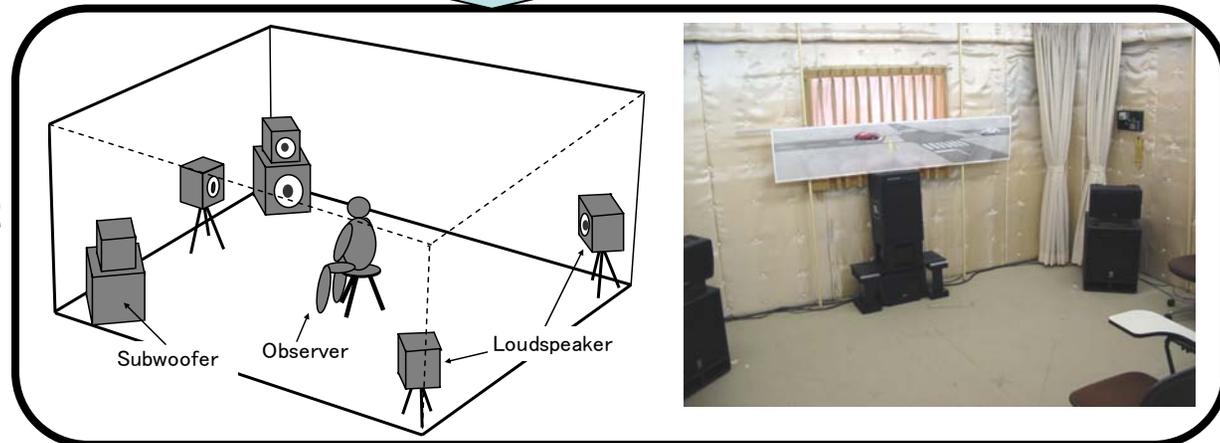
Between



A bustling street
(Corresponding MEGA WAVE at Tokyo meeting)

Presentation of back ground noise individually

Setup of noise hearing experiment



Under each ground noise, noises of a number of ICEV and HV, which recorded in site, mixed and presented to subjects.

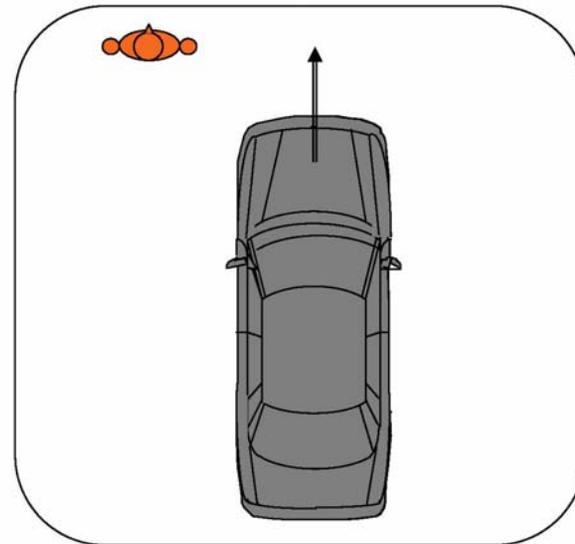
When subjects noticed the approaching or existence of a vehicle, subjects asked press the button.

After the end of each scene, we asked the questions below.

“Under the scene like this, do you think you distinguish the approaching or existence of a vehicle by sound (oral sense) only, or by sight (visual sense) as well?”

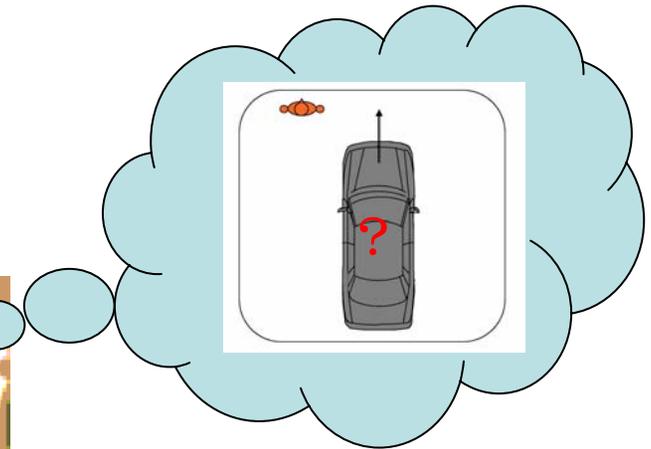
- a. by sound (auditory sense) only.
- b. by both sound (oral sense) and sight (visual sense)
- c. I cannot tell which or both.
- d. I do not know

please select your answer

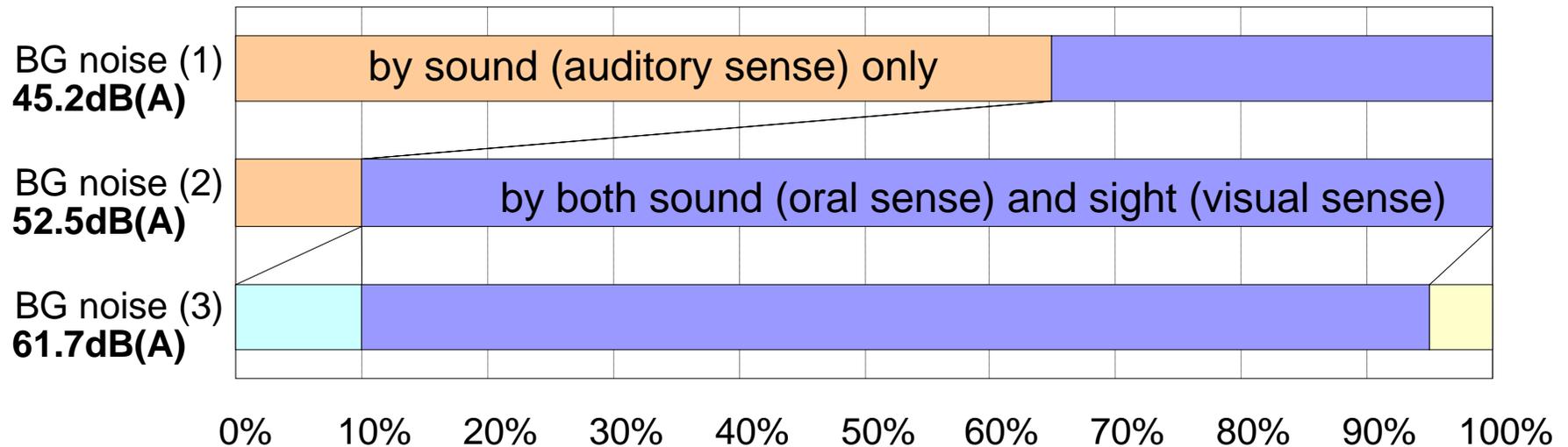


Considerable Background Noise Range

Q: With these levels of background (BG) noise, do you think you would judge on approaching/presence of vehicles based on sound (by hearing) only? Or based on sight (by vision) as well?

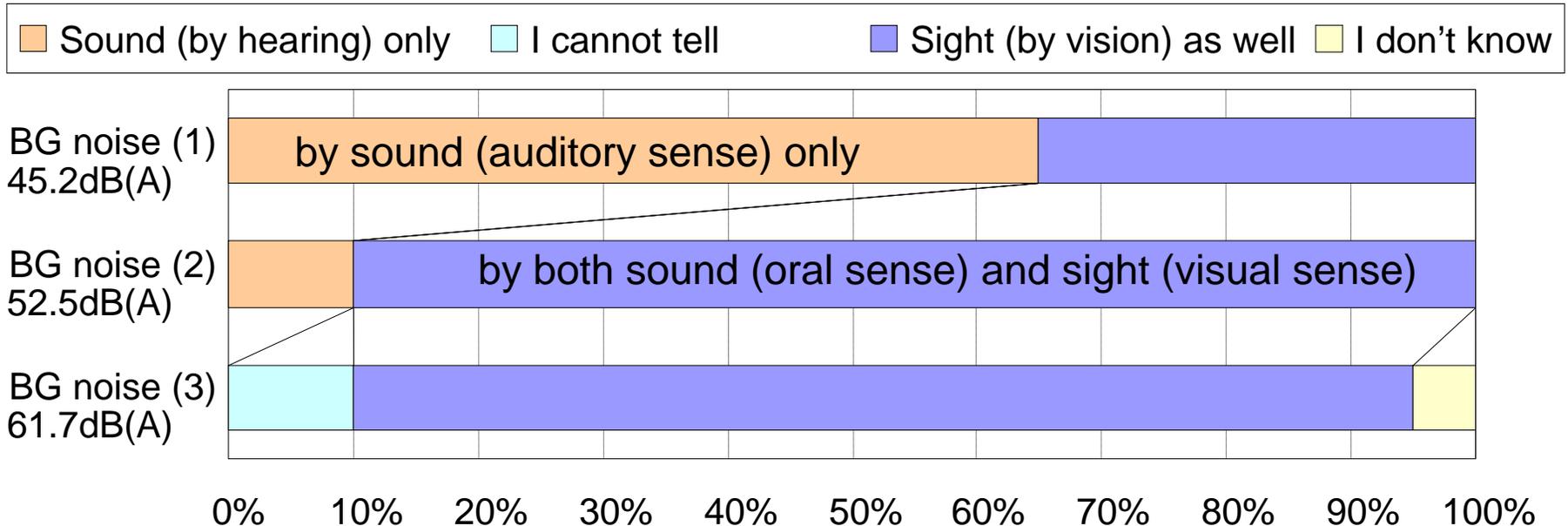


Sound (by hearing) only I cannot tell Sight (by vision) as well I don't know



The level of background noise that can be judged based on sound (by hearing) only was LAeq=52.5dBA or below.

Considerable Background Noise Range



-In case of low background noise, if pedestrians cannot hear approaching vehicle sound, they may judge no vehicle there and may take unexpected behavior.

⇒ **This is the issue which has to be considered.**

-In case of high background noise, it is out of scope for this issue since pedestrians do not judge approaching vehicle by only sound.

-Under the background noise more than $L_{Aeq}=60\text{dB}$, sound is not the only tool to tell the approaching vehicle.

⇒ **Consideration of such high background noise requires higher sound level than ICE and cause further noisier environment.**