Measurement of Cognitive Workload: Detection Response Task - DRT ISO 17488

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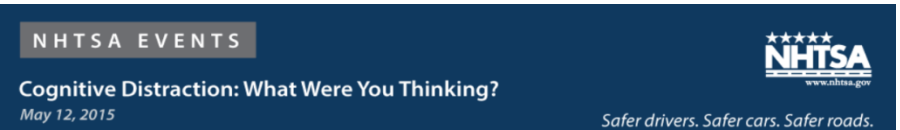

Overview

1. Cognitive Workload/Distraction
2. What does the impact of Cognitive Workload look like?
3. Approaches to measuring Cognitive Workload in controlled research environments:

   ISO Standards 15007-1 & 2 & **DRT 17488**

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1. About Cognitive Workload

Cognitive Workload: Mental resources required to perform a task

- present to a greater/lesser degree in all tasks (visual, manual, cognitive...)

    e.g., Planning, organizing, holding information in memory....

Cognitive Distraction: Diversion of mental resources from driving in dual-task conditions

Cognitive Tasks Can Be Very Demanding

Subject: Medical Appointments Next Week

Hello:

You have two medical appointments next week as part of your annual check-up schedule.

Your appointment with your dentist is not preceded by your appointment with your doctor.

Please remind the administrative assistant to book your next appointments during these visits.

Please confirm:

The order of your medical appointments is doctor then dentist.

YES/NO?

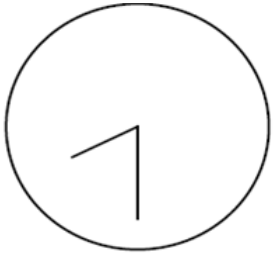
Correct answer is “no”. Example of Difficult message (Passive negative construction using “is not preceded by”)

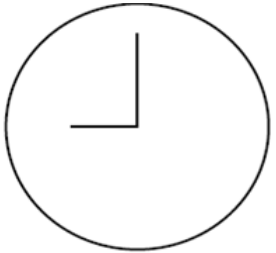
(From Harbluk & Lalande, 2005)

Presentation Format ≠ Processing Format

Task: At which of these 2 times do the clock hands form the greater angle?

1. “Eight thirty & nine” (auditory)
2. 8:30 & 9:00 (visual)





“Driving is a visual manual task”
One strategy to reduce visual distraction is to present a task in a non-visual format (e.g., speech) There can be strong biases for the processing of information that are independent of the presentation format.

2. What does the impact of cognitive workload look like?

Effects of cognitive workload can be difficult to observe

and hard to measure

Use of controlled experiments (simulator or on road) controlled conditions, defined tasks

Fundamental human factors assumption- high workload impairs performance

Cognitive Workload can Impact Visual Behavior

Changes drivers look inside & outside the vehicle/ disruptions in patterns of visual scanning

Areas of Interest (AOI), concentration of gaze

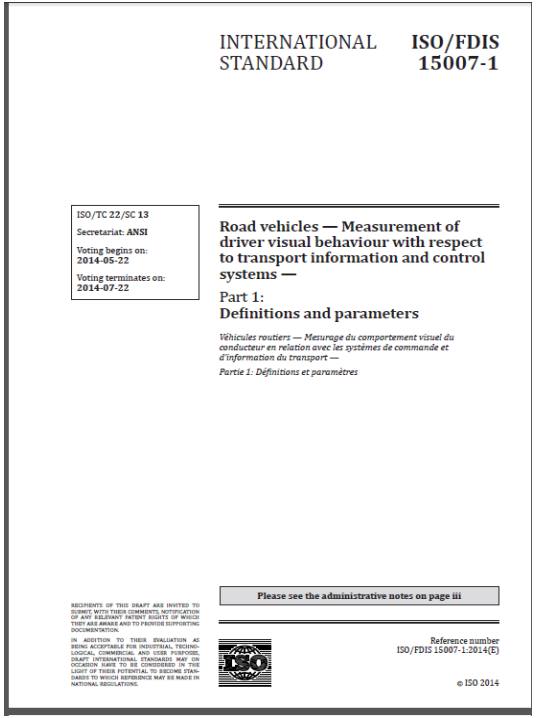
Missed detections or delayed detections

Visual Scanning: Cognitive Task

3. Approaches to Measuring Cognitive Workload

Standards:

- Provide a consistent approach
- Comparable results across studies



INTERNATIONAL STANDARD **ISO/FDIS 15007-1**

ISO/TC 22/SC 13
Secretariat: ANSI
Voting begins on: 2014-05-22
Voting terminates on: 2014-07-22

Road vehicles — Measurement of driver visual behaviour with respect to transport information and control systems —

Part 1:
Definitions and parameters

Véhicules routiers — Mesurage du comportement visuel du conducteur en relation avec les systèmes de commande et d'information du transport —

Partie 1: Définitions et paramètres

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Please see the administrative notes on page iii

Reference number
ISO/FDIS 15007-1:2014(E)

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Standards: ISO 15007-1: 2014

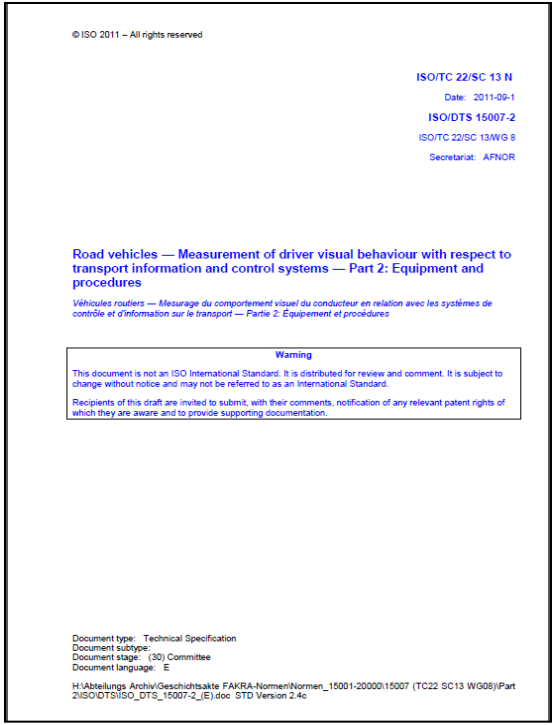
Road Vehicles. Measurement of driver visual behaviour with respect to transport information and control systems. Definitions and parameters. (2014).

Key terms & parameters for analysis of driver visual behaviour- glances & glance-related measures

- Common reference, consistency in approach, empirically based methods, best practices

ISO 15007-2:2014

- Road Vehicles. Measurement of driver visual behaviour with respect to transport information and control systems. Equipment and procedures. (TS, August 2014)



ISO/TC 22/SC 13 N

Date: 2011-09-1

ISO/DTS 15007-2

ISO/TC 22/SC 13/WG 8

Secretariat: AFNOR

Road vehicles — Measurement of driver visual behaviour with respect to transport information and control systems — Part 2: Equipment and procedures

Véhicules routiers — Mesurage du comportement visuel du conducteur en relation avec les systèmes de contrôle et d'information sur le transport — Partie 2: Équipement et procédures

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Detection Response Task (DRT)

Assessment of the effect of cognitive load imposed by performing a secondary task while driving

Driving + Secondary Task + DRT (stimulus every 3-5 s)

Logic: To the extent that the additional secondary task is demanding, performance on the DRT is affected; see longer reaction times compared to when there is no secondary task

Methods of Stimulus Presentation & Response

Head Mounted

In the Driving Scene

Tactor on Skin

Response made by pressing finger switch

ISO Collaborative Research for DRT Standard Development (ISO 17488)

Volvo (Sweden) & **TNO** (The Netherlands)

IFSTTAR (France)

TU Munich (Germany)

US labs: Wayne State, DRI

Malaysian Institute of Road Safety Research (MIROS)

Transport Canada

Task Conditions

Baseline: no secondary task; drive & DRT

Secondary Task: Auditory /Verbal Tasks:

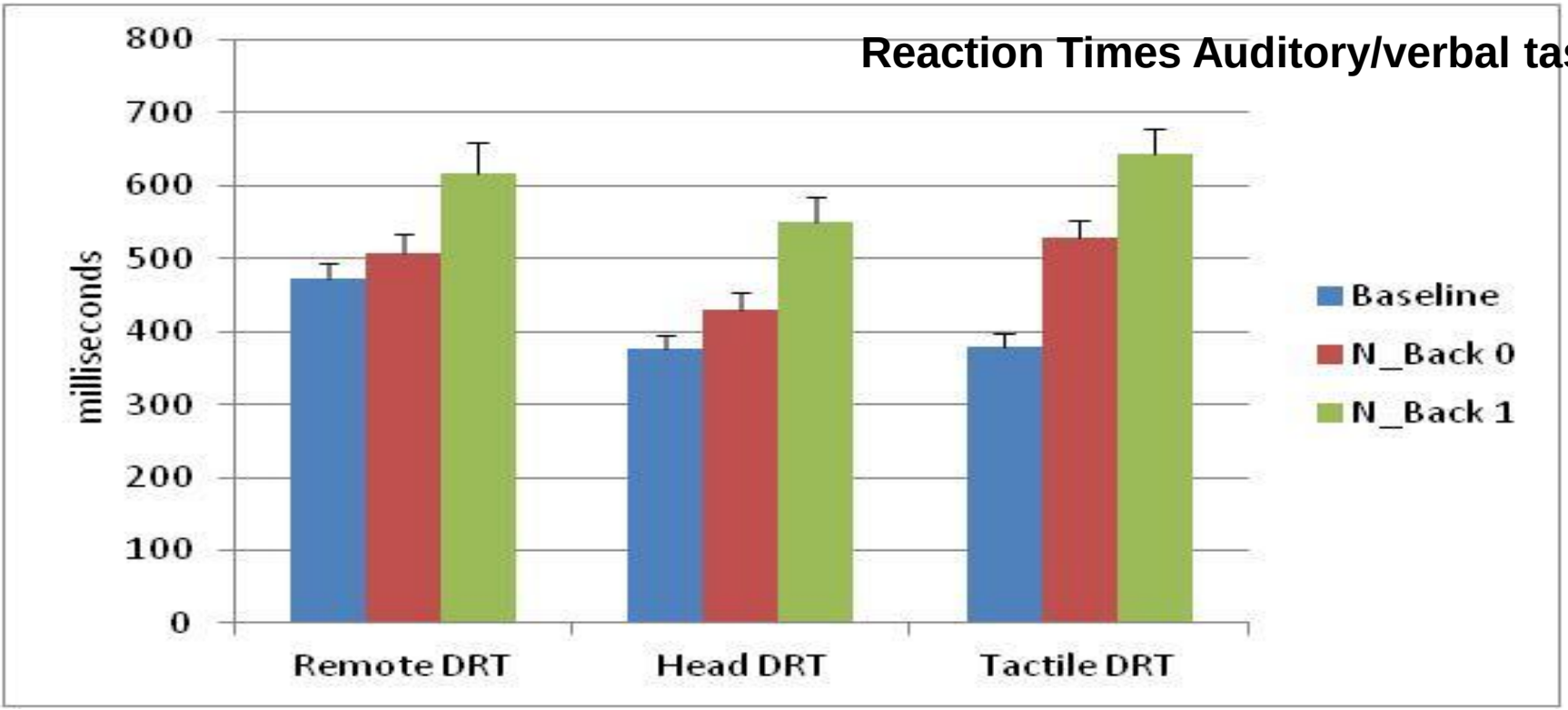
N-back: 0, -1 [artificial task]

0-back

I say:	3	2	6	7	1
You Say:	3	2	6	7	1

1 back

I say:	3	2	6	7	1
You Say:		3	2	6	7



Mean reaction times (+ SE) for N-Back tasks by DRT version

DRAFT INTERNATIONAL STANDARD ISO/DIS 17488

ISO/TC 22/SC 13 Secretariat: AFNOR

Voting begins on 2015-04-06 Voting terminates on 2015-07-06

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Road vehicles — Transport information and control systems — Detection-Response Task (DRT) for assessing attentional effects of cognitive load in driving

Véhicules routiers — Systèmes de commande et d'information du transport

ICS 35.240.60; 43.040.15

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ISO DIS 17488: Detection Response Task

- Draft International Standard
- Voting & comments
- Final version expected May 2016

DRT: An established & effective way of assessing Cognitive Workload

- Sensitive to increased cognitive demand
- 3 implementations: head, remote, tactile
  - Tactile DRT has advantage over Head DRT since it can be used with eyetracking equipment without interference
- Simulator, desk top set up, on road
- For assessments of tasks & activities in controlled situations

Thank you for your attention!

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