

# On The Nature of Distraction: Driving Beyond the Barriers of Hindsight

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## Presentation Content

1) The Driving Problem

2) Is Driving the Distraction?

3) On Driver Distraction

4) The Distracted Driver

5) Toward Potential Solutions?

# **THE DRIVING PROBLEM**

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**Why Should Understanding Driving Still Be a Problem?**

**After All,**

**We Have Been Driving Now For More Than A Century!**

**It is One Of The Most Practiced Of All Adult Skills.**

**It is The Most Litigated Form Of Human Activity?**



## ***Some Reasons For The Continuing Frustration***

- 1) ***The Problem of Dynamic Intention***  
***We Understand Perhaps 50% of 5% of the Problem***
- 2) ***The Problem of Dynamic Context***  
***What is Meant by Distraction and Indeed - Error***
- 3) ***Affective Response to New and Existing Technologies***  
***A Love-Hate Relationship***
- 4) ***The Problem of System Coupling and Causality***  
***Difficult to Comprehend as an Integrated System***

## **THE SCOPE OF THE DISTRACTION PROBLEM**

### **Recent Figures on Distracted Driving**

Almost 80% of all crashes and 65% of near crashes in the United States are caused by distracted drivers.

Just Cell phone use alone is directly contributing each year to:

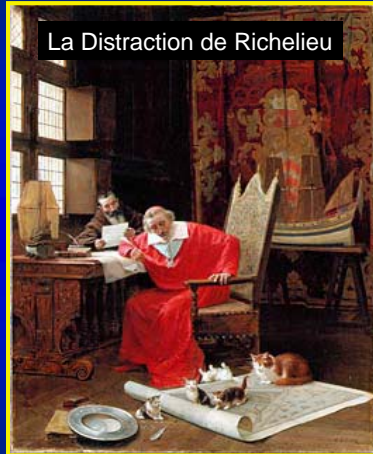
- 6% of Crashes, 636,000 Wrecks.
- 330,000 Injuries.
- 12,000 Serious Injuries.
- 2,600 Fatalities.
- \$43 Billion Economic Impact.

**National Highway Transportation Safety Administration [NHTSA].**





## TO BEGIN: Distraction is Not a New Issue It Has Been a Concern for Driving Since the Very Beginning



La Distraction de Richelieu

### A History of Driving Distraction

By 1913, mechanical windscreen wipers were standard equipment on American cars. However, many criticized them, predicting their rhythmic motion would distract drivers and lull them into a trance-like state (*Automotive Engineering*, February, 2001).

When car radios were first introduced it was argued, that drivers would not be able to listen in an concentrate on the road at the same time.

Charles Édouard Delort (1841-1895), Huile sur toile, The Detroit Institute of Arts, 1995.  
(Here the Artist is the **Arbiter of Attraction and Distraction**)

### For Example



EVEN WITHIN THE TRANSPORT SYSTEM  
THERE ARE ADDITIONAL DIMENSIONS  
OF DISTRACTION BEYOND THE DRIVER

For Example, the Distracted Pedestrian



## OTHER POTENTIALLY DISTRACTED ROAD USERS



Skateboarders



Horse Riders



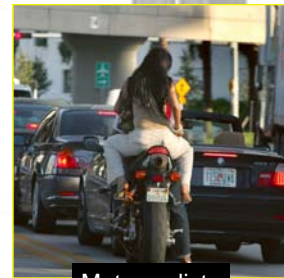
Bicyclists



Animals



Road Workers



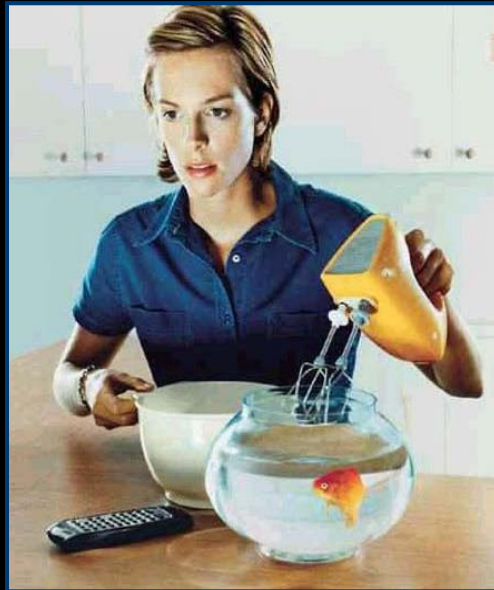
Motorcyclists

## AND BAD THINGS HAPPEN WHEN



OPEN-LOOP DRIVERS MEET OTHER OPEN-LOOP USERS

## But, What Is It We Are Distracted From?



Distraction, (and its Natural Antithesis – Attraction)  
Logically Imply the Existence of An **External Arbiter**.

It is this **External Arbiter** who is the Agency  
that Specifies **What** We Should be **Attracted** to.

This **Arbiter** Can be **Nature** –  
Or it Can Be **Society**.

The Former is **Naturally Imperative**,  
the Latter is **Socially Imperative**.

Both Forms of Imperative are  
**Necessarily Underspecified**.

We Shall Return to the Issue of **Arbitration**,  
BUT FIRST -

## **IS DRIVING THE DISTRACTION?**

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**Predominantly, the Underlying Driving Task is Getting from Origin to Destination**

**But, When Individuals Have Sufficient Resources, Their Choice is NOT to Drive**



**Therefore, it may be DRIVING which is the DISTRACTION**





It is thus important to understand that, although our focus here is on driving, that may well not be the driver's continual focus.

First International Conference on  
**Driver Distraction  
and Inattention**

**Call for Registrations**

September 28-29, 2009  
Lindholmen Science Park  
Gothenburg, Sweden

Therefore, we may be making a category error if we posit this is so. Society may also make that same error in its assumption of ubiquitous driver responsibility.

Thus, we need to examine what can distract from the role of Driver.

## **DRIVER DISTRACTION**

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**Question:** When is a Driver then NOT a Driver?



**Answer:** When They are Something Else!

### What Other Roles Can Drivers Assume While Driving?



**Avid Texters and Tweeters**

Peter Hitchens (Columnist): *Mail On Sunday*, September 6<sup>th</sup>, 2009.

"Personally, I'd impose a mandatory six months' hard labour, followed by a long stint as a cleaner in A&E, for anyone convicted of texting while driving, and three months for people who use hand-held phones at the wheel. These cretins are consciously taking a heartless risk with the lives of others, and if reason won't work then fear will have to do."

**These Activities are Seen by Society As An Intentional and Voluntary Role Conflict**

<http://www.gwent.police.uk/leadnews.php?a=2172>

## What Other Roles Can They Assume While Driving?



**Society sees this as an Unintentional  
and Involuntary Role Conflict**

**Distraction is Thus Requires the Examination of 'Free Will'.**

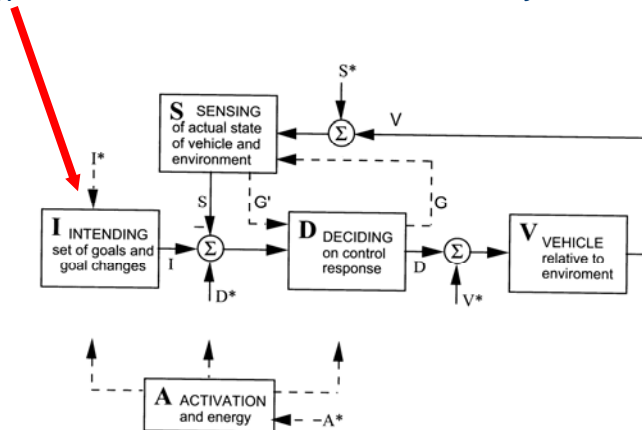


**Breast-feeding, Cell-using Driver Charged  
Ohio Police cite Woman with Child Endangerment.**

<http://www.msnbc.msn.com/id/29441879/>



Formally Then, the Driver 'qua Driver' is Distracted from this Role When (I) the Stack of Intended Goals is not Headed by the Driving Task.



I Suggest This Happens Dynamically and Almost Continuously. It is an IMPLICIT Form of Distraction whose Frequency Is Often Underestimated.

Sheridan, T.B. (2004). Driver distraction from a control theory perspective. *Human Factors*, 46 (4), 587-599.

**However, the Issue of Role is also Conflated with that of Personal and Social Space.**



Thus, externally, the Car (as a Vehicle) is a SOCIAL Object.



However, internally one's own Car is a PERSONAL Space.

**Thus, it is not only the Driver but the Very Constitution of the Vehicle Itself which is Conflicted.**

For some, their car is their ONLY Private Space. It is the LOVE of their life. It can be thought to Represent an EXTENDED UTERUS. When you threaten The Integrity of their vehicle, you are threatening their view of their mother.

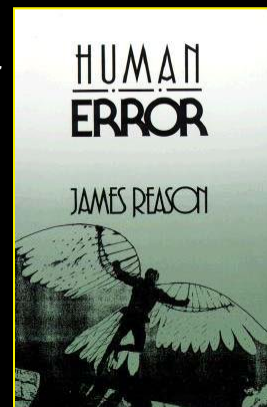


## Further Complications

Peter Hitchens (Columnist): *Mail On Sunday*, September 6<sup>th</sup>, 2009.

"Personally, I'd impose a mandatory six months' hard labour, followed by a long stint as a cleaner in A&E, for anyone convicted of texting while driving, and three months for people who use hand-held phones at the wheel. These **cretins** (users) are consciously taking a **heartless risk** with the lives of other (transportation system users), and if **reason won't work then fear will have to do.**"

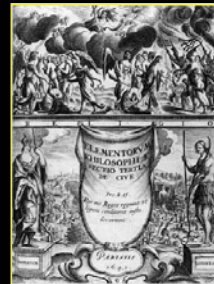
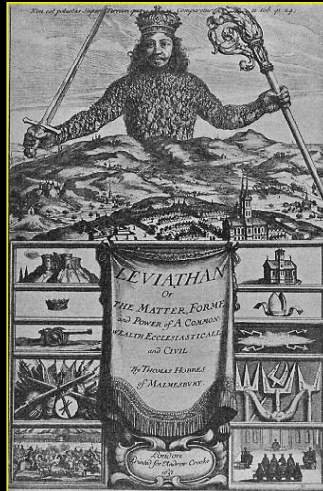
Note here the **ABSENCE OF ANGER** with those who **DESIGN, CREATE, and FABRICATE** the Technologies Involved. It treats Drivers (Users) as being under a **SOCIAL IMPERATIVE** but **Technology** (Manufacturer's) as being under a **NATURAL IMPERATIVE**. It contrasts, Personal vs. Corporate responsibility. This indicates the issue has a strong **MORAL DIMENSION** and is partially framed (and therefore partially must be solved) as a **POLITICAL Issue**.



Perhaps We Can Get Him to See "Reason."

Thus reactions are tempered by **Culture** and **National** (Socially Collective) Attitudes

## Individual vs. Collective Responsibility



Individual

Collective

It Is Indicative of Where the Balance Stands Between the Individual and the Collective

Hobbes, T. (1651). *Leviathan*. Crooke: London.

## Recent U.S. Politics

Recent Reports Have Suggested that Researchers and Administrators at the U.S National Highway Traffic Safety Administration (NHTSA) were encouraged NOT to report on certain problems associated with distracted driving. (and see Editorial Comment by M. Carswell, *Ergonomics in Design*, 17 (3), 3.)



If the Issue of Distraction is so Critical (Internationally), why was the U.S. Meeting scheduled against this one?

New York Times: July 21<sup>st</sup>, 2009. ([www.nytimes.com/2009/07/21/technology](http://www.nytimes.com/2009/07/21/technology))



## There Are Multi-Dimensional Motivations

While the Issues seems to be a science-based question, in reality there are:

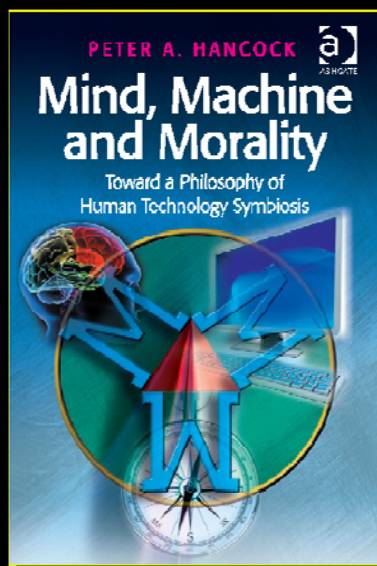
- i) Social,
- ii) Political,
- iii) Cultural,
- iv) Financial, and
- v) Moral Dimensions

These act to inform and sometimes to obscure debate.

If we, as scientists, do not understand these forces, our science will be used for personal, political, social, and financial motives. In fact, they already are.

**"If you can bear to hear the truth you've spoken twisted by knaves to make a trap for fools."**

These are some of the Dimensions I have Looked to Feature in a Recent text.



Please Pardon the Advertisement and Distraction which are Immoral, I know.

## Summary: Distracted From the Role of Driver

Multiple Social Roles Adhere in All Individuals

Even Sitting Here Today, We Each Still Possess These Differing Facets

These Roles are Dynamic and Their Priority Changes Frequently

Humans Are Dynamic, Adaptive and Bore Easily

Even While Driving the Role of Driver is Often Subordinated

Social Role Changes Intrude with Changing Circumstances

Role Reorientation Possibilities Derive from the Satisficing Nature of Driving

Normal Driving for an Experienced Driver is NOT Overtaxing

Admonition is Insufficient an Imperative in An Habituated Skill

Performing 'Automated' Skills, People 'Forget' Dire Warnings

### Within-Driving There Are Also Goal Hierarchies:

Thus There Are Differing Intentions Even When 'Driving' is the Singular Goal

#### Optimizing vs. Satisficing

The overwhelming predominance of driving concerns **satisficing** the contextual demands. Events which require **optimization** are very exceptional. We make a **category error** when we apply optimization measures (e.g., RT, Error Rate) to these satisficing conditions.

#### Hedonism versus Utilitarianism

"The Safe and Efficient Transit of People, Goods, and Services" vs. "I Love/Hate My Car"

#### Personal Travel versus Passenger Transport

#### Professional versus Non-Professional





## **THE DISTRACTED DRIVER**

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Sgt. Locicero, and Capt. Elliot, of the Niagara County Sheriff's Department, examine a towing truck that drove into a swimming pool in Lockport, N.Y. on July 30, 2009. The tow truck driver was juggling two cell phones, texting on one and talking on the other, when he slammed into another car and crashed.



## A TYPICAL CASE?

(AP Photo/Lockport Union-Sun & Journal, Stephen Wallace). The 68 year old driver of the other car and her passenger suffered minor injuries. Nicholas Sparks was charged with reckless driving.

### *The Driving Task*

**One of the Most Practiced of All Human Skills.**

**Predominantly Satisfied, Rather Than Optimized.**

**Perhaps Because Effort Minimization Applies (As With Most Skills).**

**Driving is an Interweave of Open and Closed Loop Control. (Senders).**

**The Transition between the Two is 'Driven' by Context via Attention.**

**There are Predictable and Unpredictable Contextual Demands.**

**Sub-Maximal Multiplexing is Common.**

**Is Our Social Imperative To Maximize Or Minimize Driving Workload?**

### What About Tight-Rope Walker Distraction?

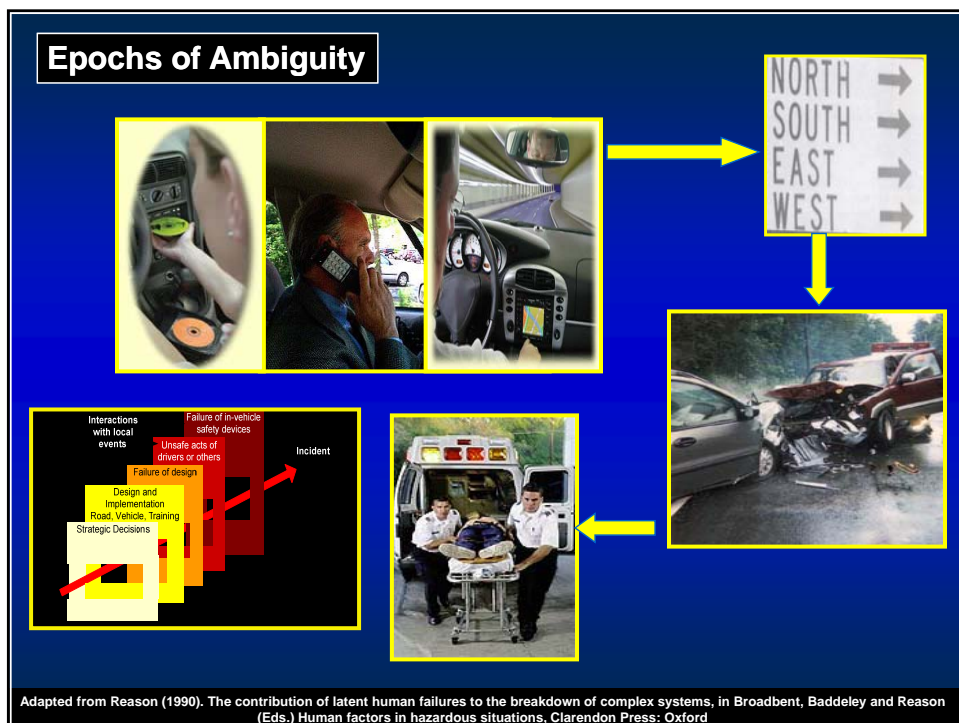


Hancock, P.A., & Caird, J.K. (1993). Experimental evaluation of a model of mental workload. *Human Factors*, 35 (3), 413-429.

### Driver Overload: The Case of the Snowplow



Hancock, P.A., Wulf, G., Thom, D., & Fassnacht, P. (1990). Driver workload during differing driving maneuvers. *Accident Analysis and Prevention*, 22 (3), 281-290.





# “Thieves” of Attention

## DRIVING

### VEHICLE

	Related	Unrelated
Inside	 <p>Navigation System</p>	 <p>Passengers</p>
Outside	 <p>Signage</p>	 <p>Attractions</p>

Even When External Sources of Information Are Relevant to Driving -

Oops, No I meant the First

You'll have to go round again  
(M32, M4)  
(M32)

Take the second exit

Look I said I was Sorry



They Are Not always Helpful.

Many External Sources of Information Are Irrelevant and Simply Distractions.



What Responsibility do Purveyors of Such Information Sustain in Distracting Drivers?

The **Arbiter** (Society) Purports to Tell us How to Drive at All times. However, this claim is False



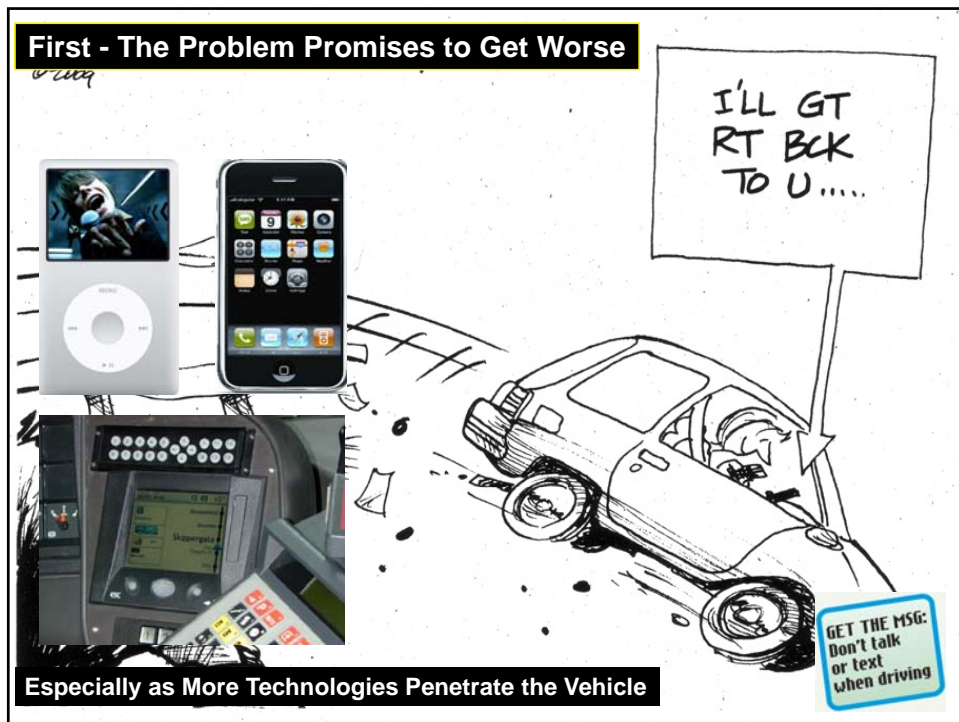
There are many spatio-temporal circumstances are **Chronically Underspecified**.

That is, drivers simply cannot pay "attention" to all possible sources of threat.



## **TOWARD POTENTIAL SOLUTIONS**

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**As A General Principle, We Need To**

**Choreograph the Dance of Driving**



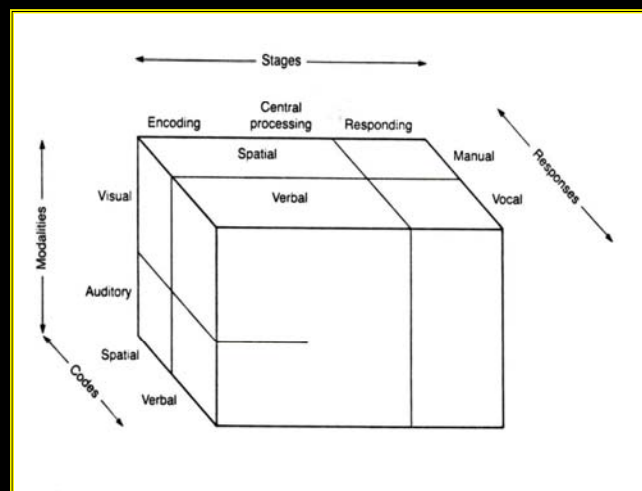
Why is it that in OPERA we can have many voices all communicating at once and the outcome is perfectly understandable? In Contrast, if several people speak at once is Chaos?



As a SOCIAL IMPERATIVE we need to Compose and Conduct a Collective Symphony of Transportation

**The First Two Registered Vehicles in Minnesota Hit Each Other**

A Possible Answer May Lie in the **Failure** of the MRT Theory of Attention.



## The Ability is Called 'TimeSharing.'

However, We Have Paid Relatively Little Attention to the Issue of Task Rhythms and the Temporal Microstructure of Tasks.



Everything is timing. The problem is synchronization with the external environment.

## Task Interruption

Interruptability is Contingent on Rhythm and Content

### % Interruptible Tasks:

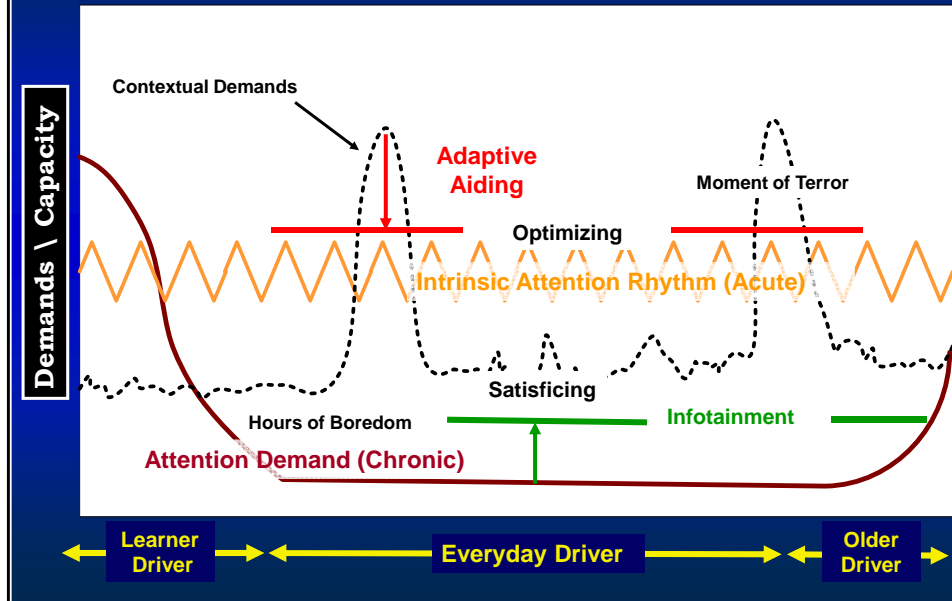
- External memory aid present.
- Driver-paced.
- Low working memory load.
- Ease of peripheral scanning.
- Low task transition costs.
- Motivation to take more time.
- Task has multiple sub-goals.

### % Non-Interruptible Tasks:

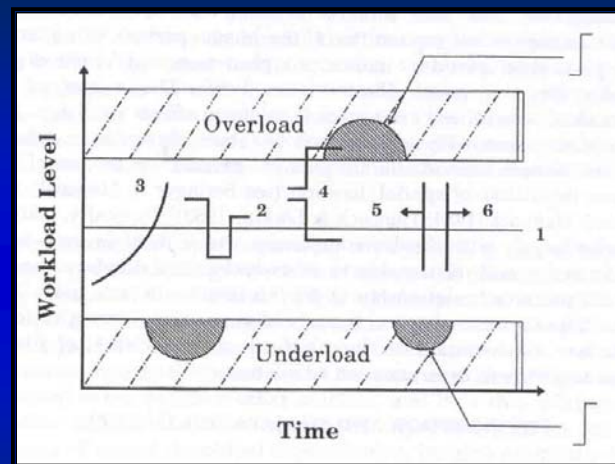
- No external memory aid.
- System-paced.
- High working memory load.
- Hard to peripherally scan.
- High task transition costs.
- Persistence/Irritability to task interruptions
- Task has few sub-goals.

Performance Degradation May Thus Derive from the Temporally Inconsistent Nature of the Competing Tasks.

## Context and Driver Attention Fluctuations

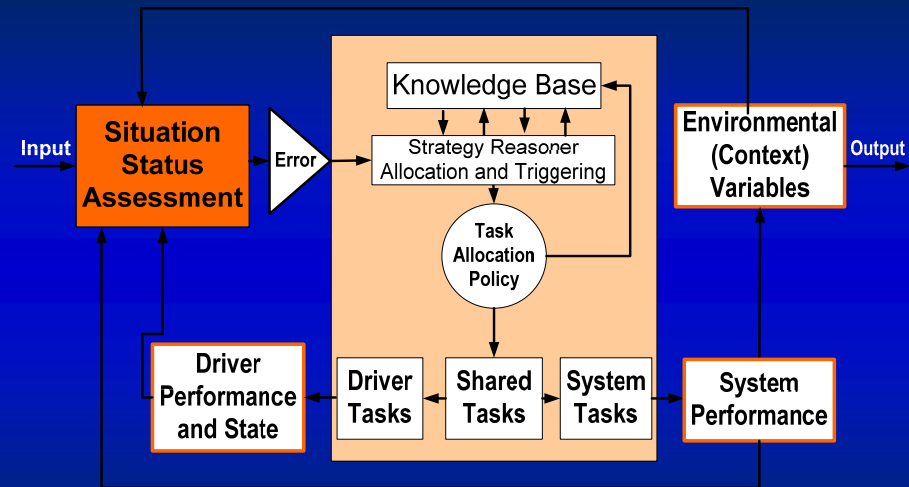


## Factors Influencing Driver Workload



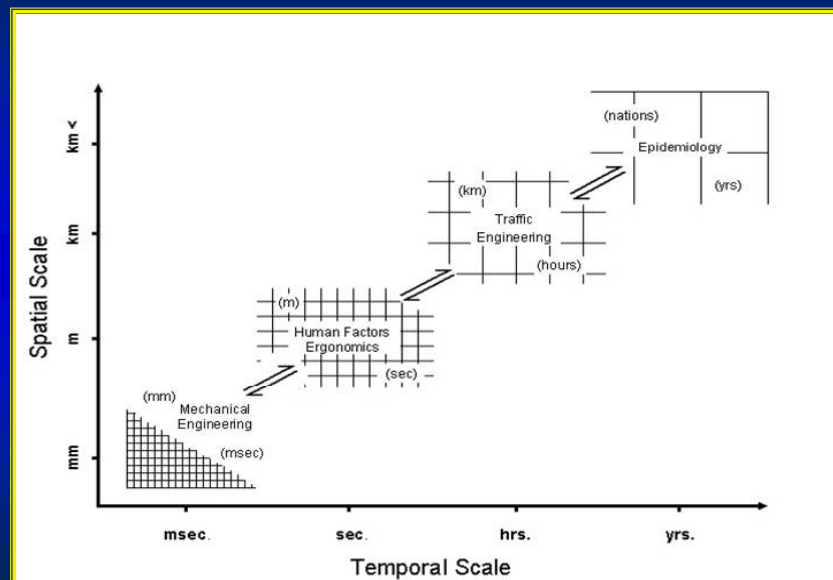
(1) Chronic Level; (2) Degree of Change; (3) Rate of Change; (4) Location of Stabilization; (5) Retrospection (History); (6) Prospection (Future). Also

## Generic Adaptive Driving Architecture



**History:** AA, KBAM, Pilot's Associate, GIDS, COMMUNICAR, Augcog, SAVE-IT, AIDE, etc.  
(Apologies for Any Missed).

## Dimensions of Context





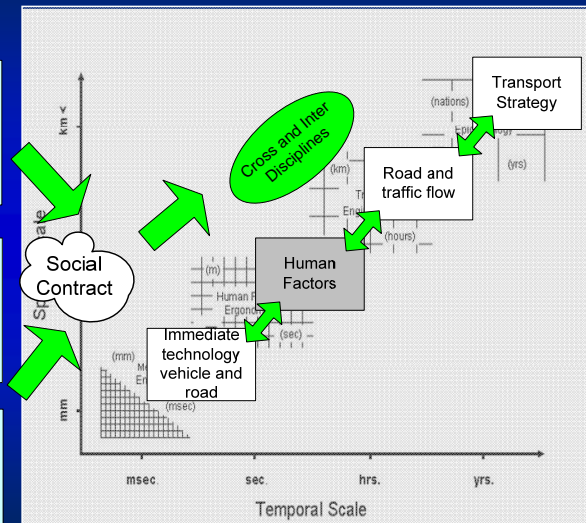
## Dimensions of Context

- Individual Driver

Idiosyncratic Choice  
Individual Belief System
- Engineering Infrastructure

Roadway Configuration  
Traffic Control Devices
- Vehicle Manufacture

Vehicle Configuration  
Sales Competition



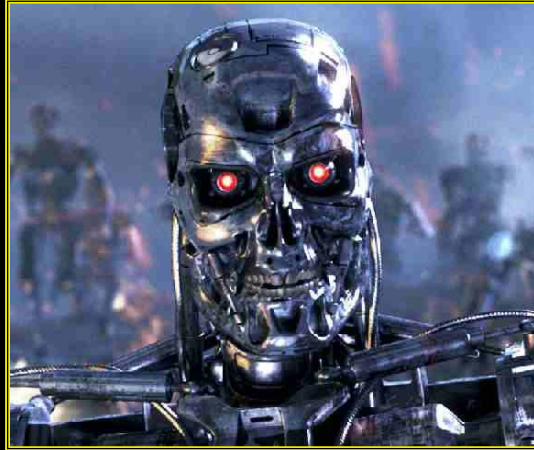
## Important Current Issues

**The Road Drives the Driver Just as Much as the Driver Drives the Road. Therefore**

**The Assessment of Environmental Contextual is Critical in order to Specify **when** Driving Is Uninterruptable (i.e., Requires Optimization) and when Selective Dual-Tasking is Permissible (i.e., Satisficing is Acceptable). In the former circumstance a Multi-Tasking **Lock-Out** is Required of the Monitoring Automation.**

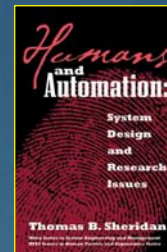
**Assessment of Mode Switching Time Remains Central to Performance Efficiency. Requires Further Understanding of Workload Transitions.**

**Distraction (Like Error) is Overwhelmingly Approached as a Post Hoc Construct in which (Society - The External Arbiter) retrospectively specifies what (The Driver) ought to have done.**



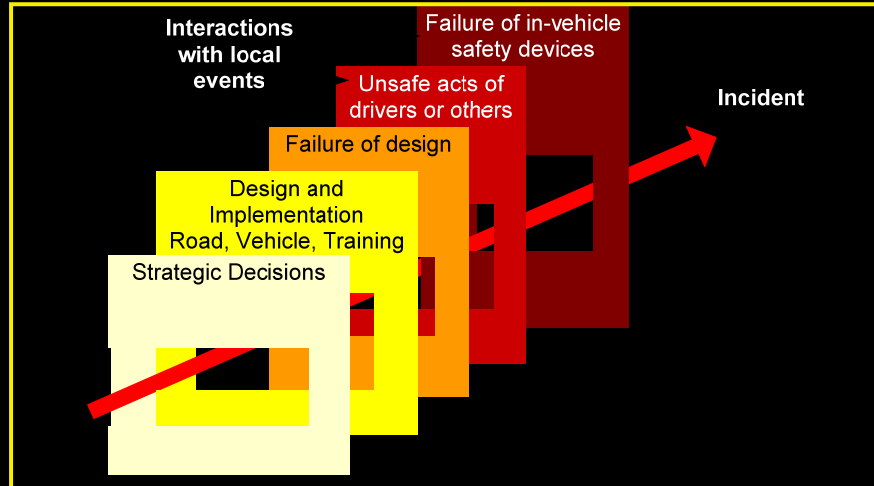
**Prospective Specification is an Apparent Anodyne to this Fallacy but it is Chronically Underspecified and Harbingers the Rise of the Machines.**

**“Automation doesn't replace human performance - it changes human performance.” (Parasuraman et al., 2000).**

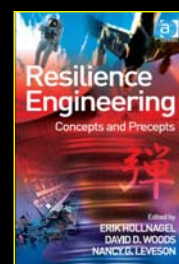
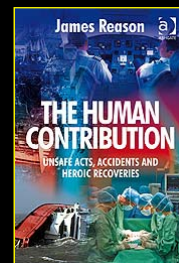
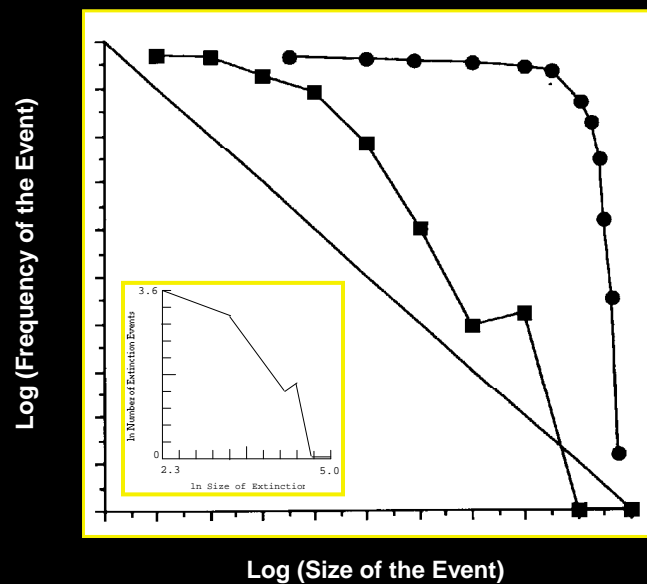


**If you Build Vehicles where Driver's are Rarely Required to Respond, They will Rarely Respond When Required.**

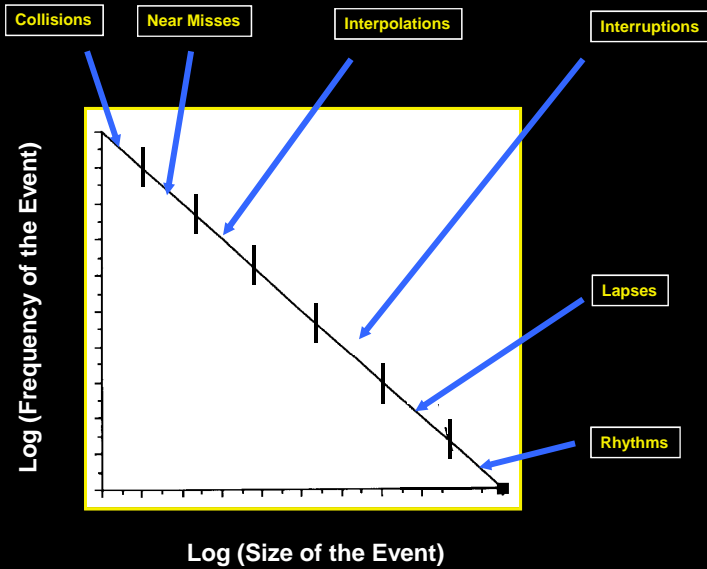
## Quantifying the “Swiss Cheese” Conception



## Quantifying the “Swiss Cheese” Conception



## Is There a Rate of Irreducible 'Failure' in Transportation Systems



## **The Last Antithesis:** Are there Benefits of Motor-Vehicle Accidents?



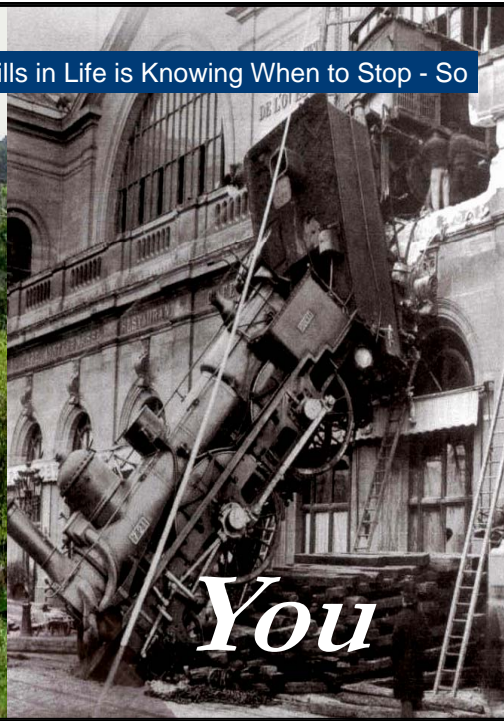
In very early 1900's in Germany, George Edward Stanhope Molyneux Herbert Had a Near Fatal Car Accident



One of the Most Crucial Skills in Life is Knowing When to Stop - So



*Thank*



*You*