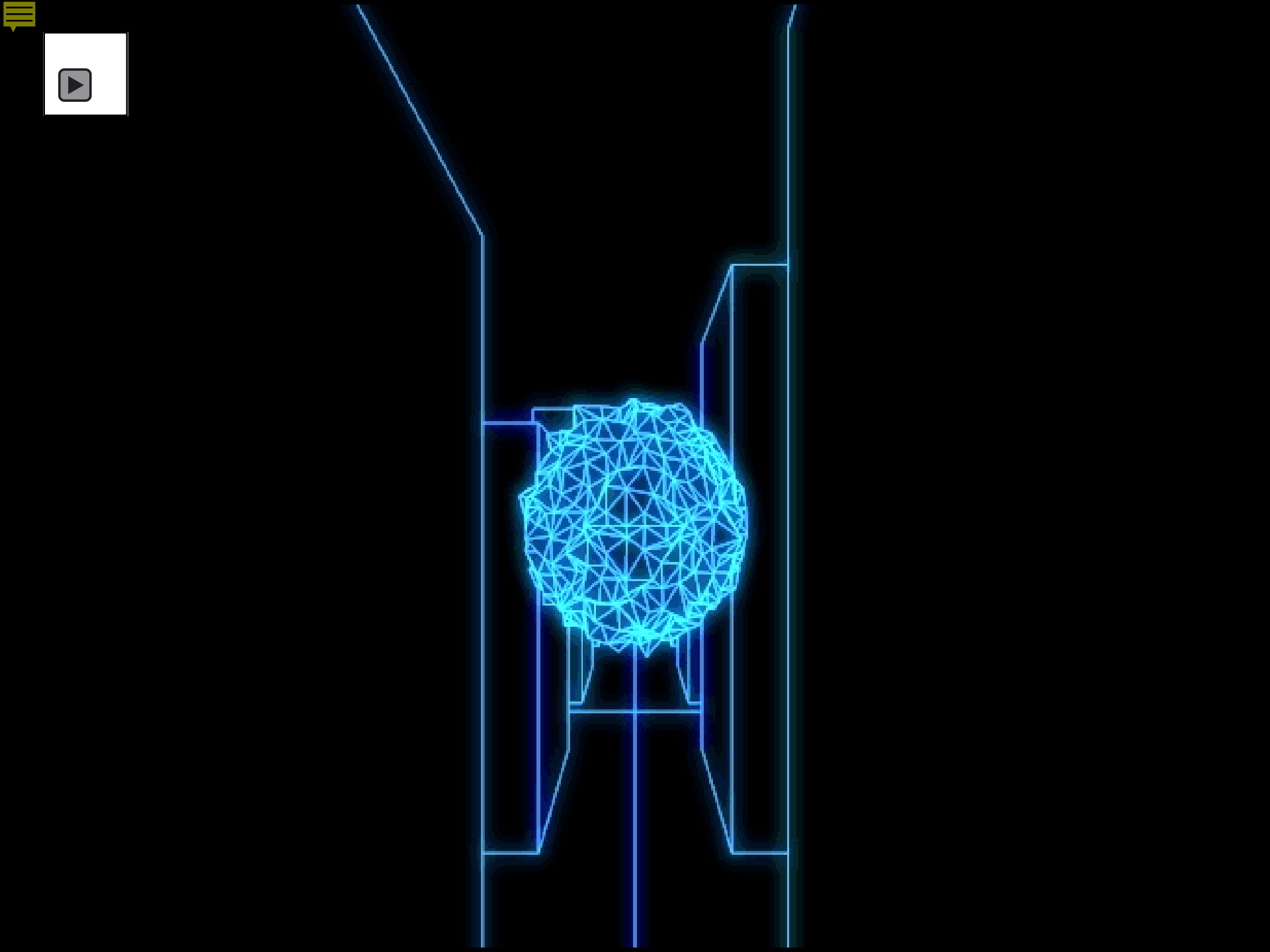


Autopia: Delta or Delusion?

Peter Hancock

Department of Psychology, and
Institute of Simulation and Training
University of Central Florida

Road to Zero, Coalition Meeting, June 13th 2017, Washington, DC.

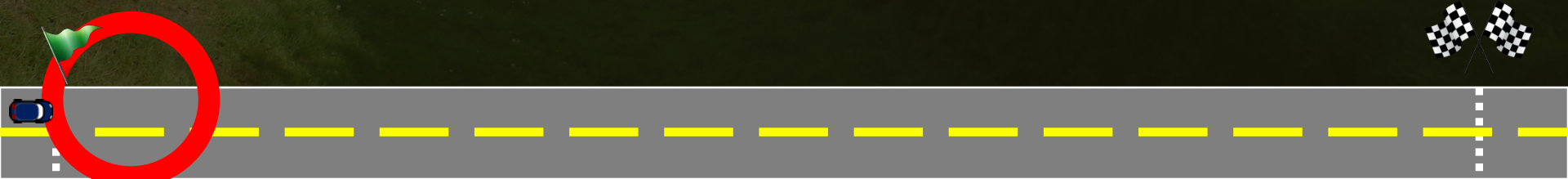
The Structure of My Presentation

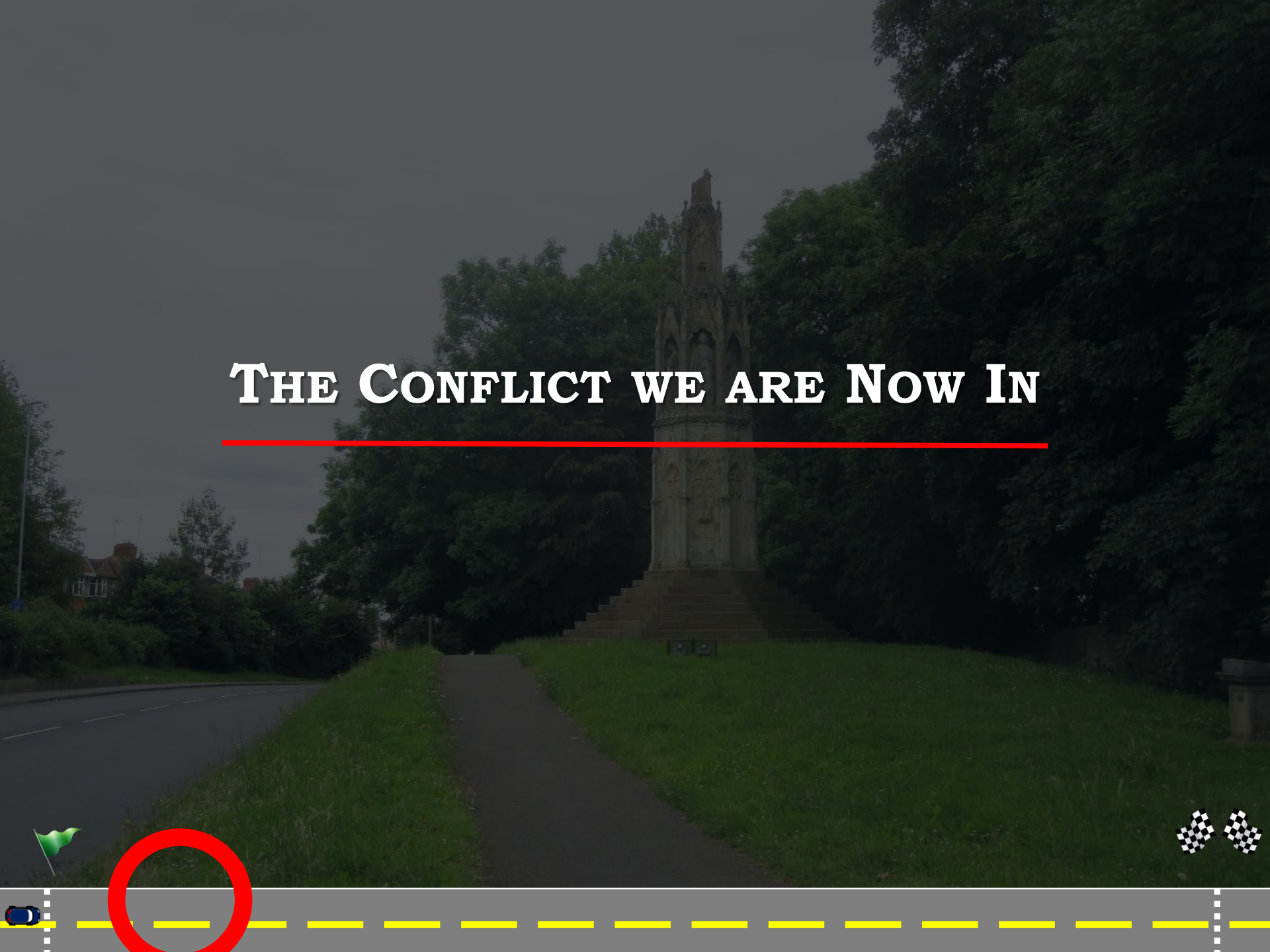
1) The Conflict we are Now In

2) How well do Humans Drive Anyway?

3) From Automation to Autonomy

4) A Glimpse of our Future




The Conflict we are Now In

With Apologies to an Ex-President

FIVESCORE AND SEVEN YEARS AGO, OUR FORE-FATHERS BROUGHT FORTH UPON THIS CONTINENT, A NEW CREATION, CONCEIVED IN DETROIT, AND DEDICATED TO THE PROPOSITION THAT ALL MEN ARE CREATED MOBILE. NOW WE ARE ENGAGED IN A GREAT WAR, TO TEST WHETHER THAT VEHICLE, OR ANY VEHICLE SO CONCEIVED CAN LONG ENDURE. AND SO TODAY, WE HERE HIGHLY RESOLVE THAT THESE DRIVERS SHALL NOT HAVE TRAVELLED IN VAIN – THAT THESE CARS, UNDER THEIR CONTROL, SHALL HAVE A NEW BIRTH OF FREEDOM – AND THAT CONTROL OF THE VEHICLE, BY THE DRIVER, FOR THE PEOPLE, SHALL NOT PERISH FROM THIS EARTH..

Are Today's Vehicles -

Computers on Wheels?

Or, Car's Driven by Super-Computers?

What Then is Autopia?

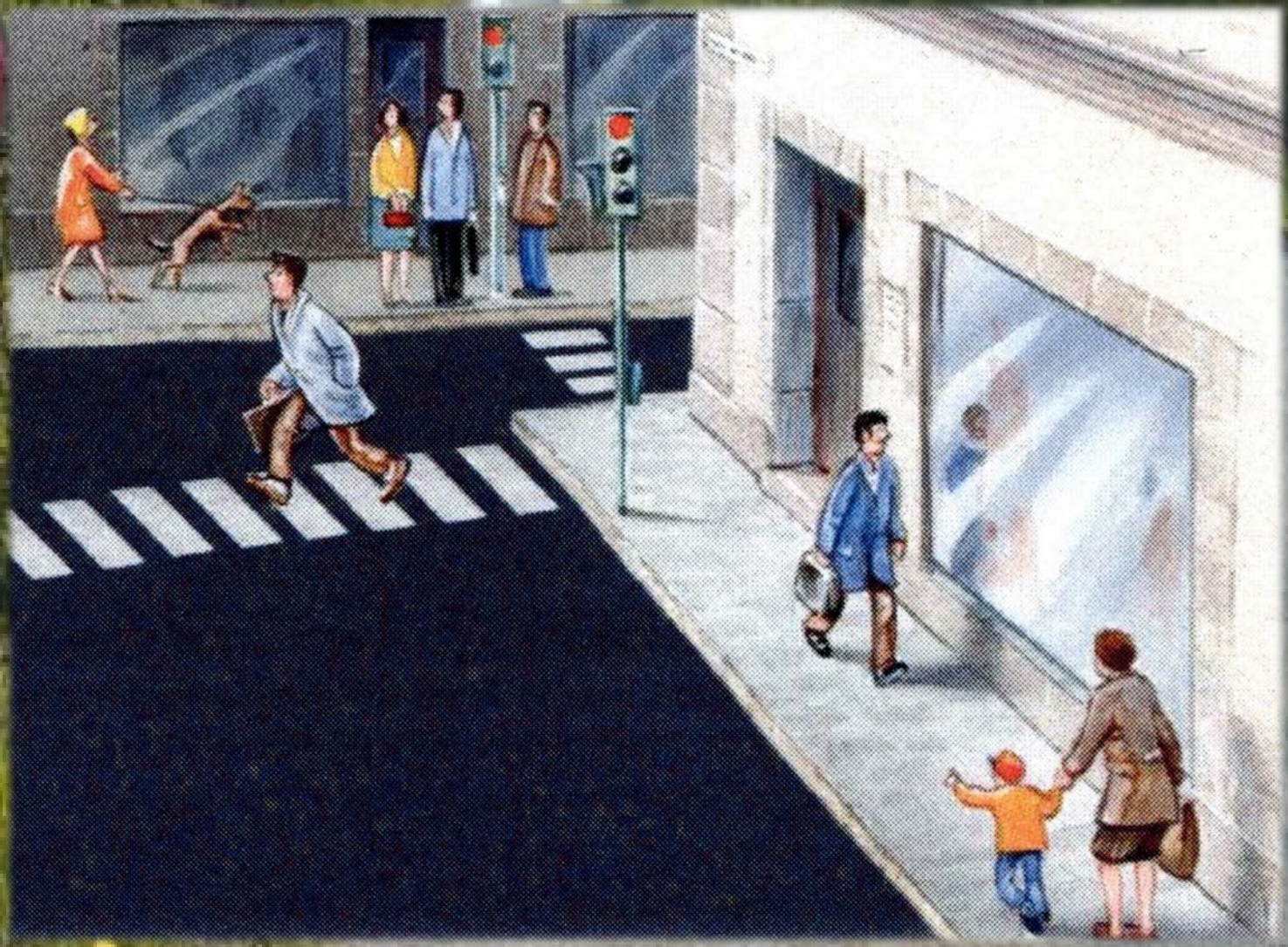
It's the Intrinsic Promise of an Automated Utopia

It Offers the Prospect of a Collision-Free Transport System.

But is Such a World Possible?

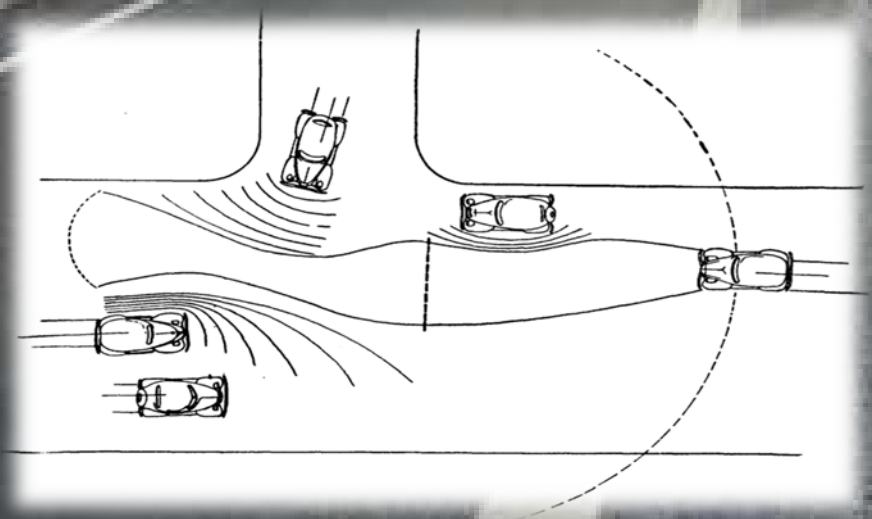
And are "Driverless" Cars the Way to Achieve It?

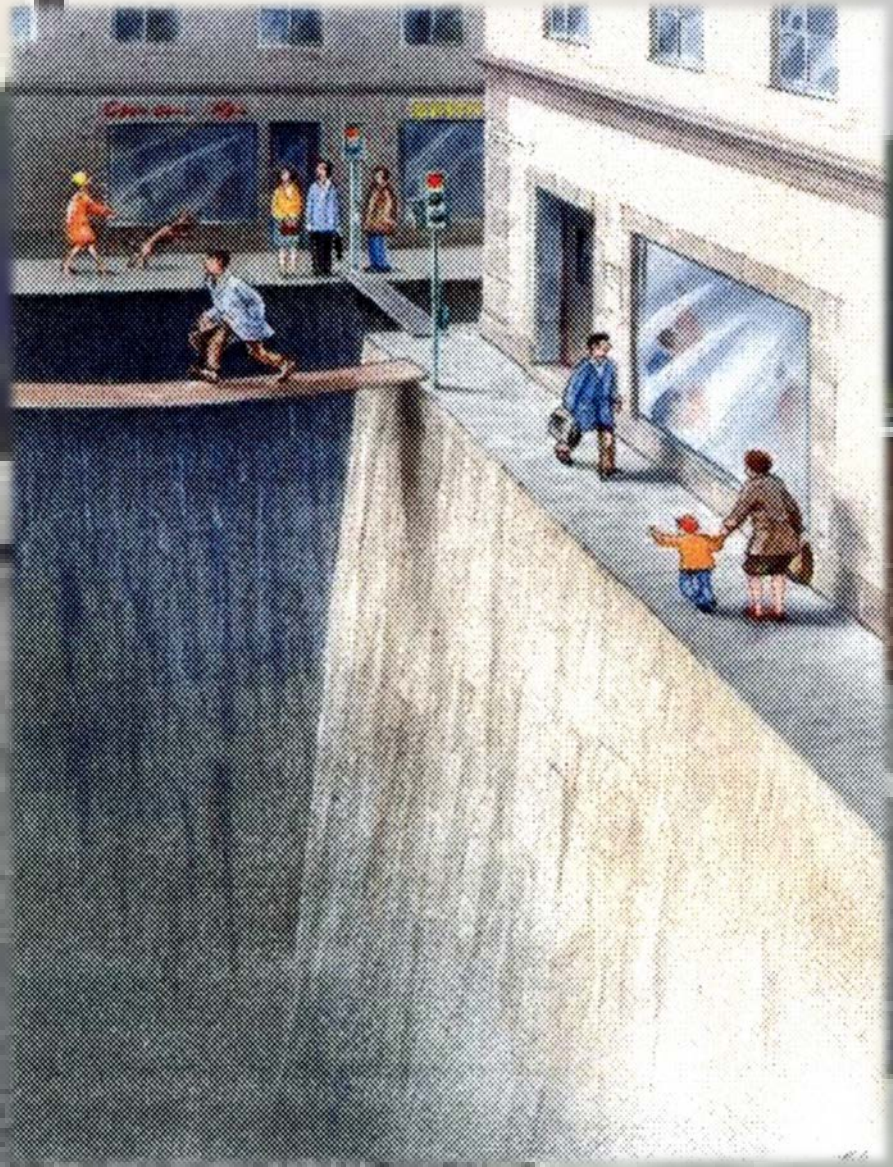
Let’s Grasp the Essence of the Problem



From: Tingvall, C. (2009). Vision zero and distraction. *Keynote Paper presented at the First International Conference on Driver Distraction and Inattention*, Gothenburg, Sweden.

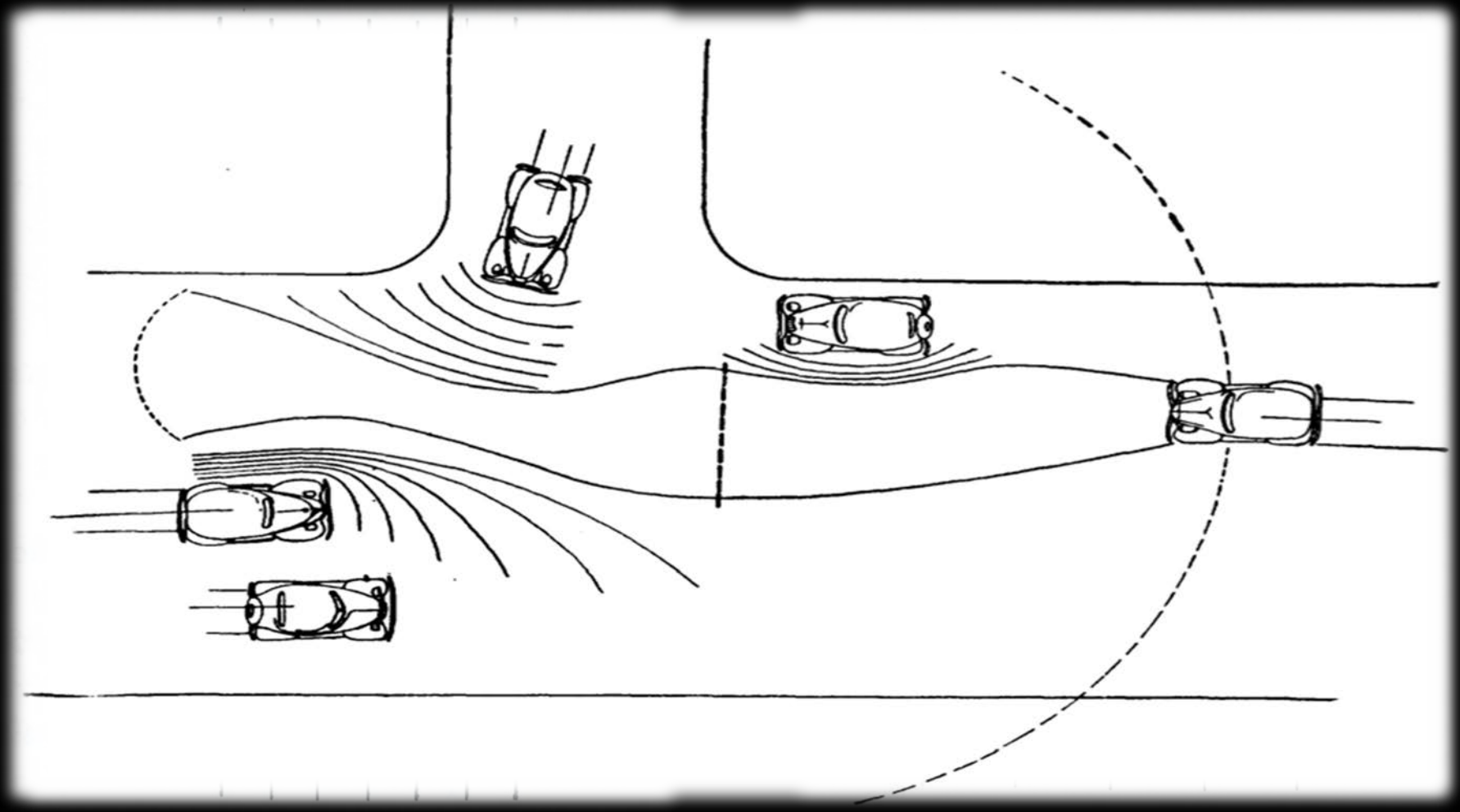
The Escape of the “Kinetic” Tiger



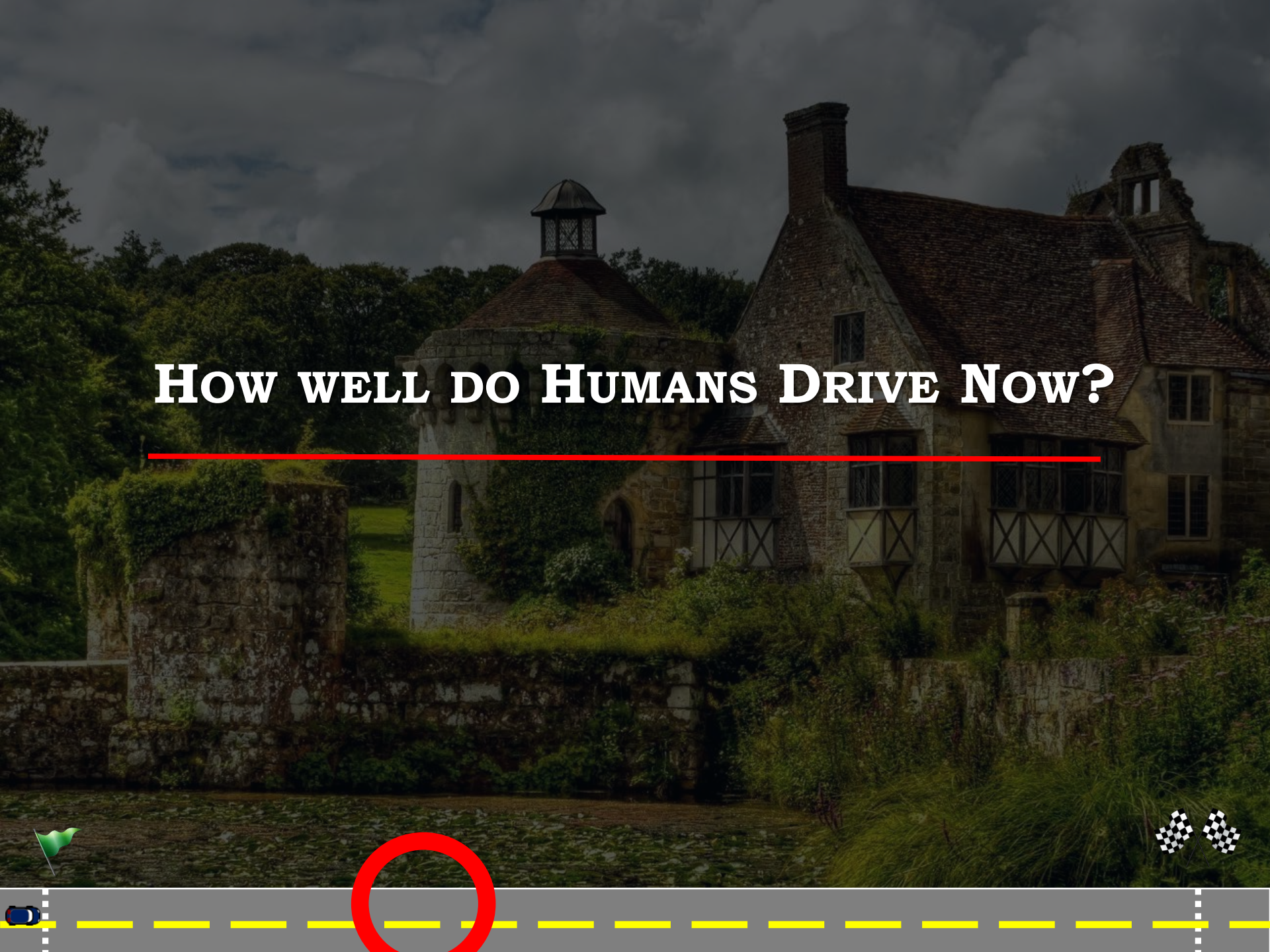


Haddon, W. (1970). On the escape of tigers. *MIT Technology Review.*

The Theoretical Antecedents of Driver-Assist?



Lewin, K. (1936). *Principles of topological psychology*. NY: McGraw-Hill.


How well do Humans Drive Now?

As of Today, Human-Controlled Driving Remains Critical Because it is:

i) A ‘Social’ Amenity of More than 100 Years in Duration.

ii) Perhaps the Most Daily Practiced of all Adult Skills.

iii) The Most Litigated of All Forms of Human Activity?

iv) The Last Great Bastion of “Apparent” Analog Control.

It is Also the Arena Where Most Individuals Will First Interact Directly with sophisticated ROBOTS

And, Make no Mistake ...

Modern-Day Cars are Robots

Built by Robots

Primum Non Nocere

(First – Do No Harm)

To do no (Further) Harm …

We have to index present Harm.

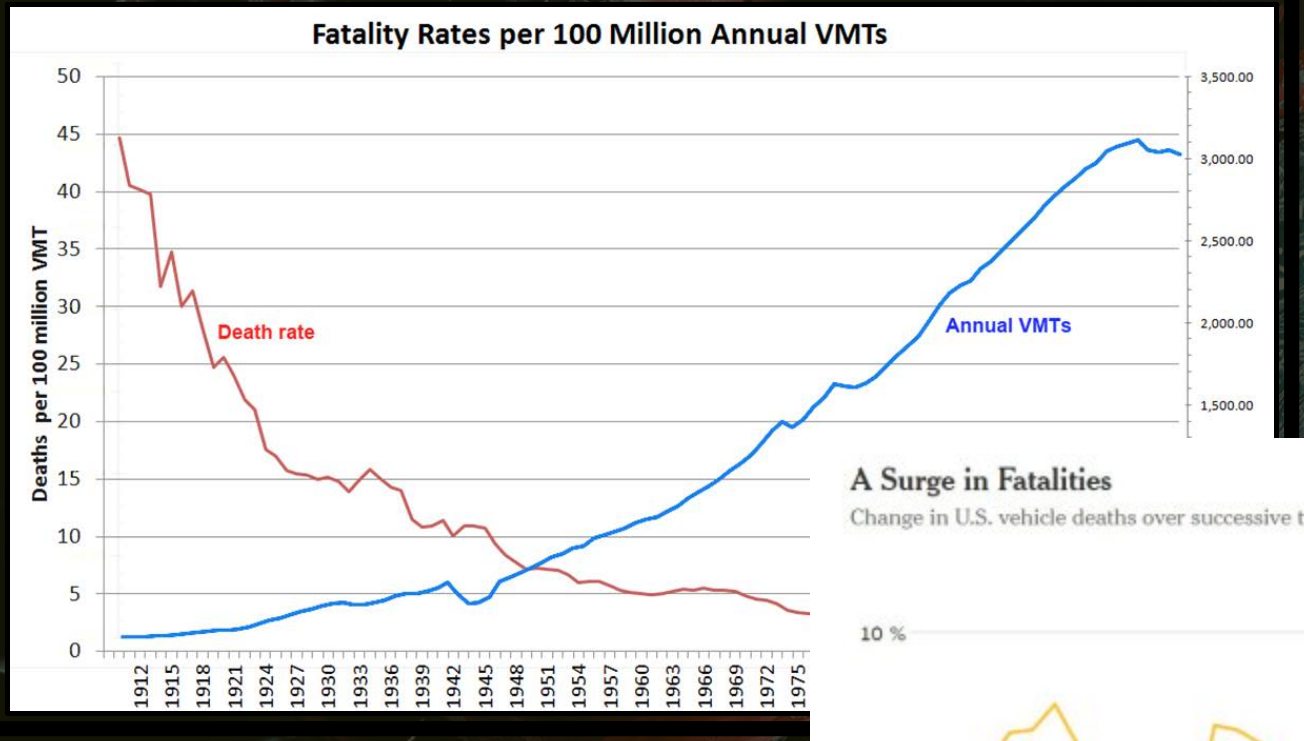
So, How well are people avoiding accidents?

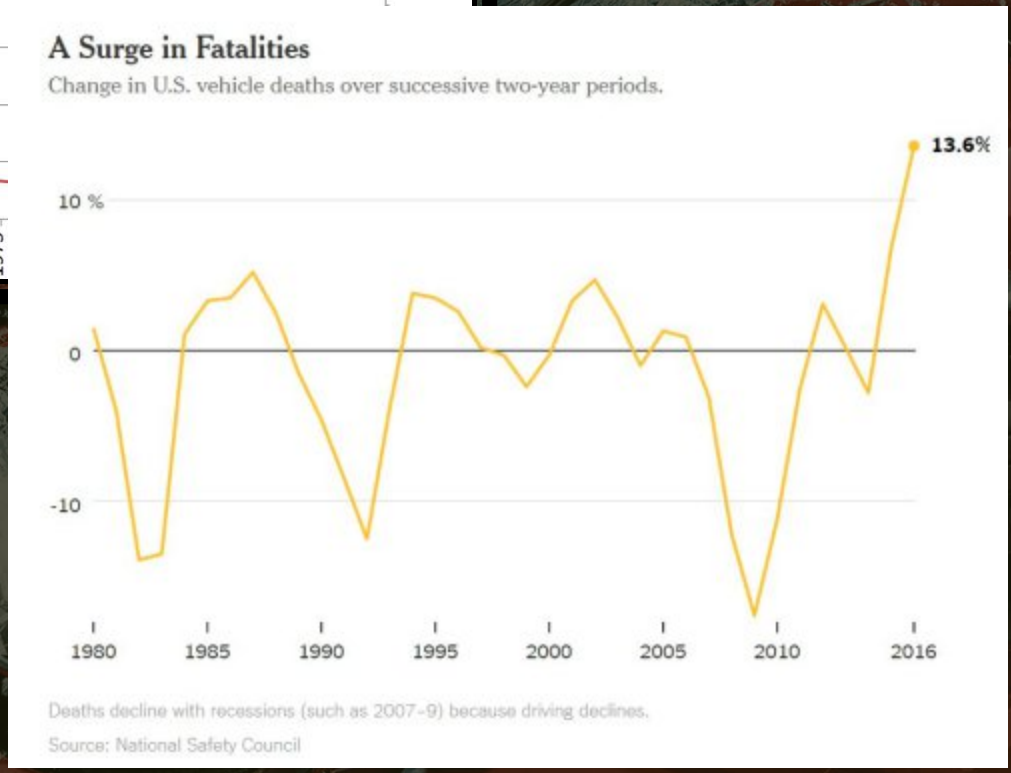
How Many Non-Accidents Happen Per day?

The Psychological Problem of 'Non-Events.'

No Distraction Problem Here then …

Current Collision Rates



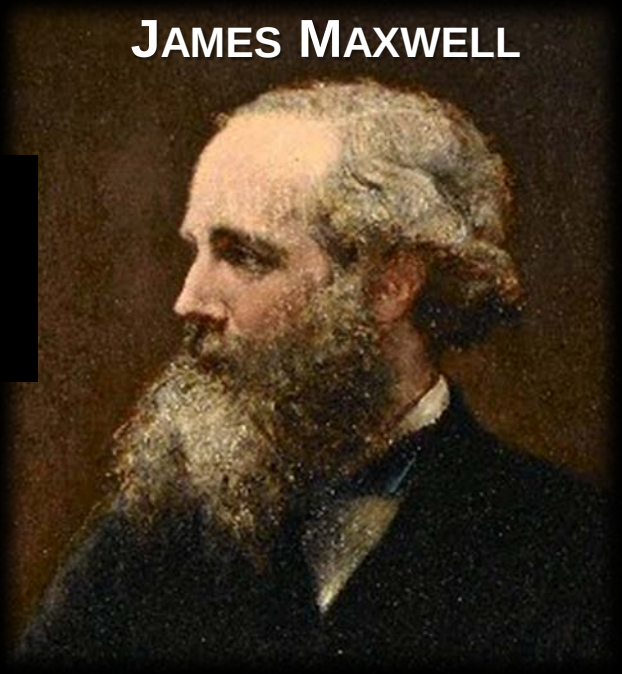


To Comprehend Non-Collisions, We Might Use Physics

Robert Boyle

We might be able to USE Boyle's Law (and Maxwell's Demon) to the Question of Non-Collisions.

James Maxwell



But in their Essence, Collisions are a HUMAN Problem

And Humans are Far from PERFECT

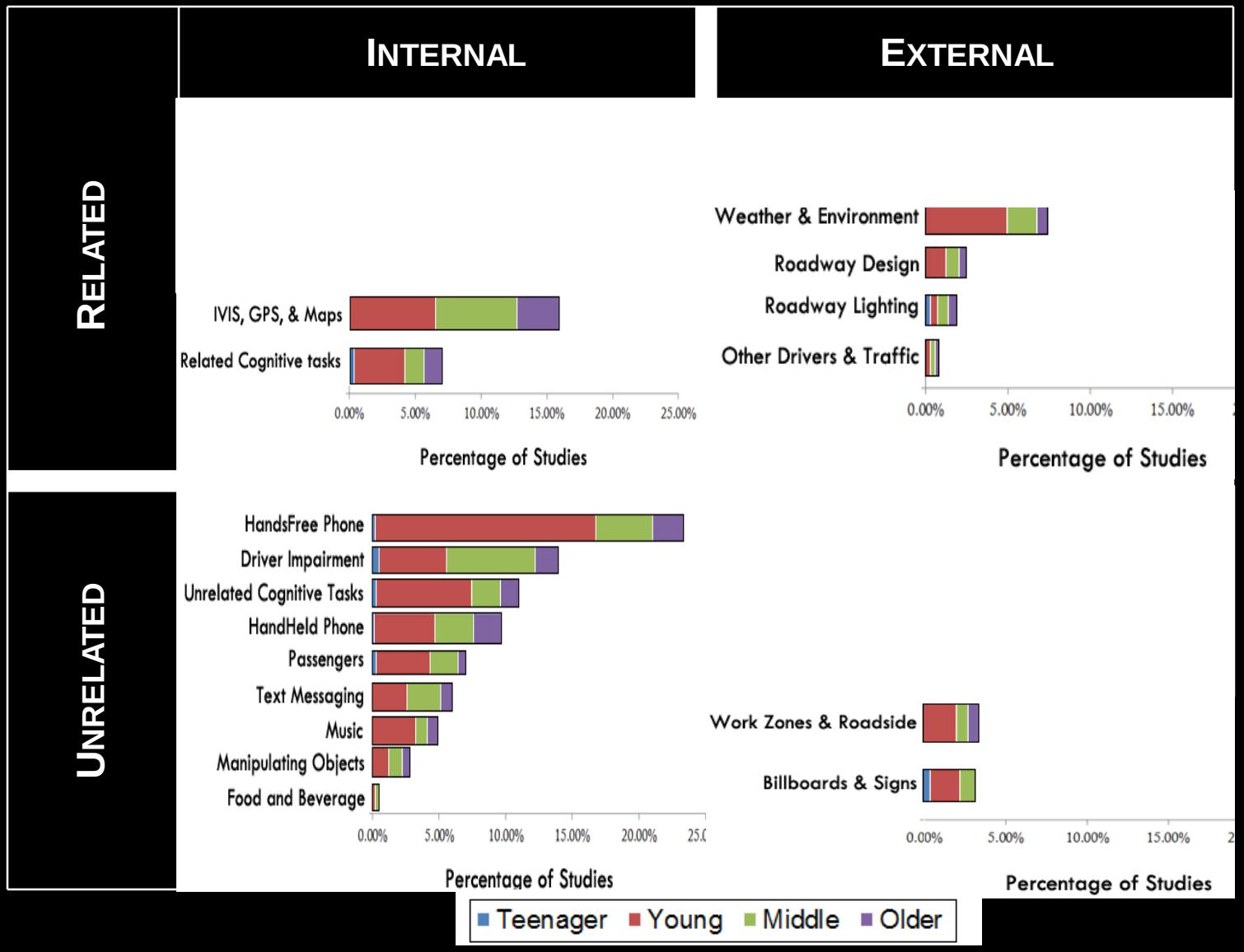
Hancock, P.A. (2013). Driven to distraction and back again. In: M.A. Regan, T. Victor, and J. Lee, (Eds.). *Driver Distraction and Inattention: Advances in Research and Countermeasures.* (pp. 9-25), Ashgate, Chichester, England.


UNITED
STATES

DISTRACTING "THIEVES" OF ATTENTION

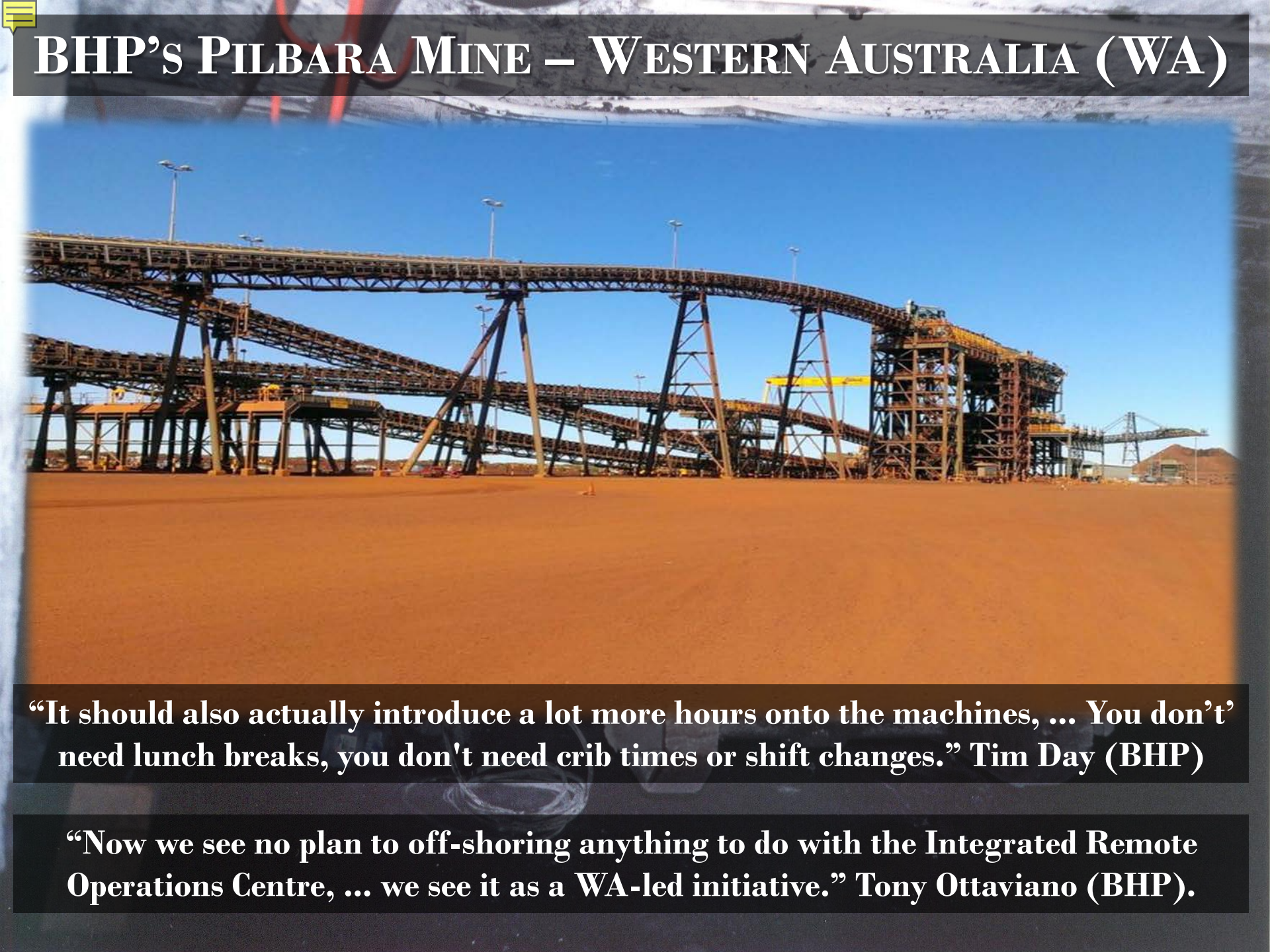
DRIVING

VEHICLE




From Automation to Autonomy

BHP's Pilbara Mine – Western Australia (WA)



"It should also actually introduce a lot more hours onto the machines, ... You don't' need lunch breaks, you don't need crib times or shift changes." Tim Day (BHP)

"Now we see no plan to off-shoring anything to do with the Integrated Remote Operations Centre, ... we see it as a WA-led initiative." Tony Ottaviano (BHP).

Automation and its Insidious Penetration:

First – An 'Apparently' Non-Threatening Example.

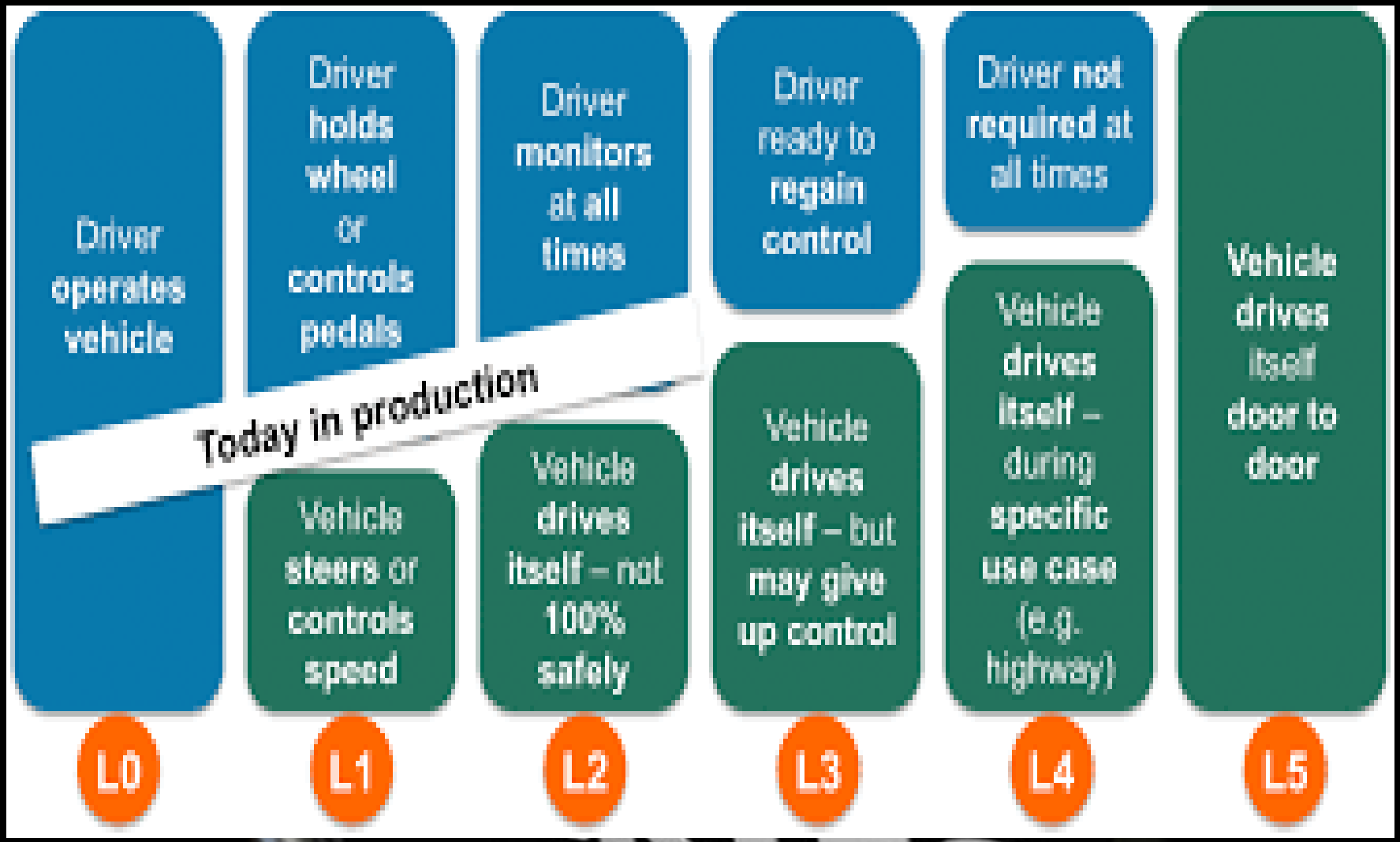
An Insidious Penetration?

*"Cows (either grazing in fields or housed in large sheds) **decide for themselves** when they want to be milked and **form an orderly queue outside** ... Some dairy parlours are now milking 24/7 without any human present."* (Private Eye).

Saki – :The Mappined Life."

"Put that Light Out"

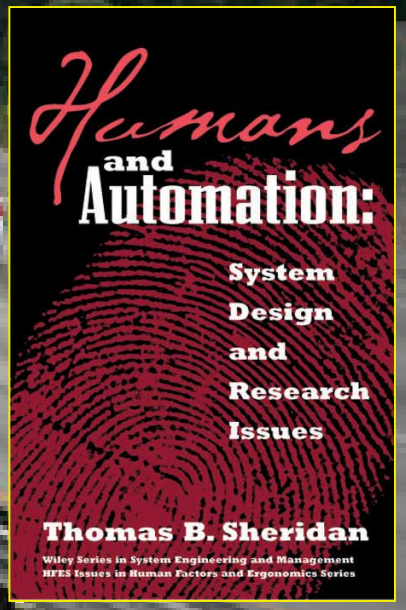
NHTSA Levels



A Description AND an Evolutionary Map

"Automation doesn't replace human performance, it changes human performance."(Parasuraman et al., 2000).

AUTOMATION

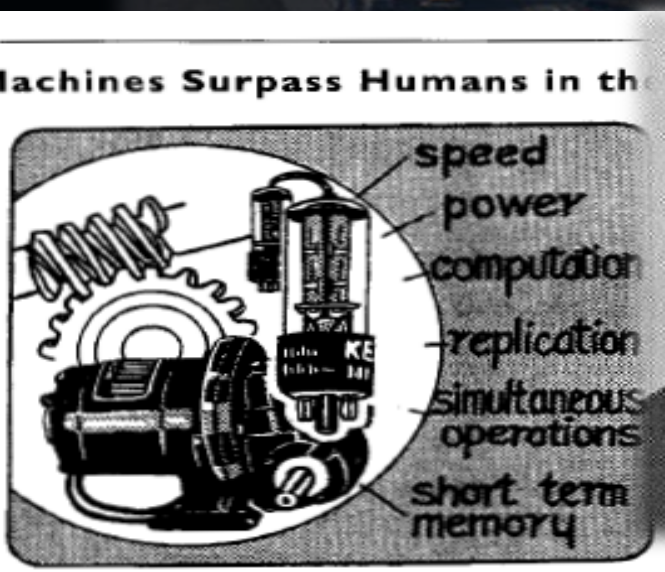


If you Build Vehicles where Drivers are **Rarely Required to Respond …**

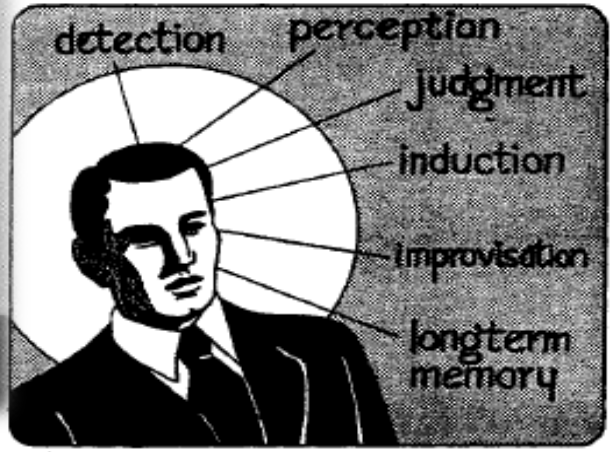
They will **Rarely Respond When Required.**

NHTSA's Hierarchy is Founded on ...

And Sheridan's Description is founded on …



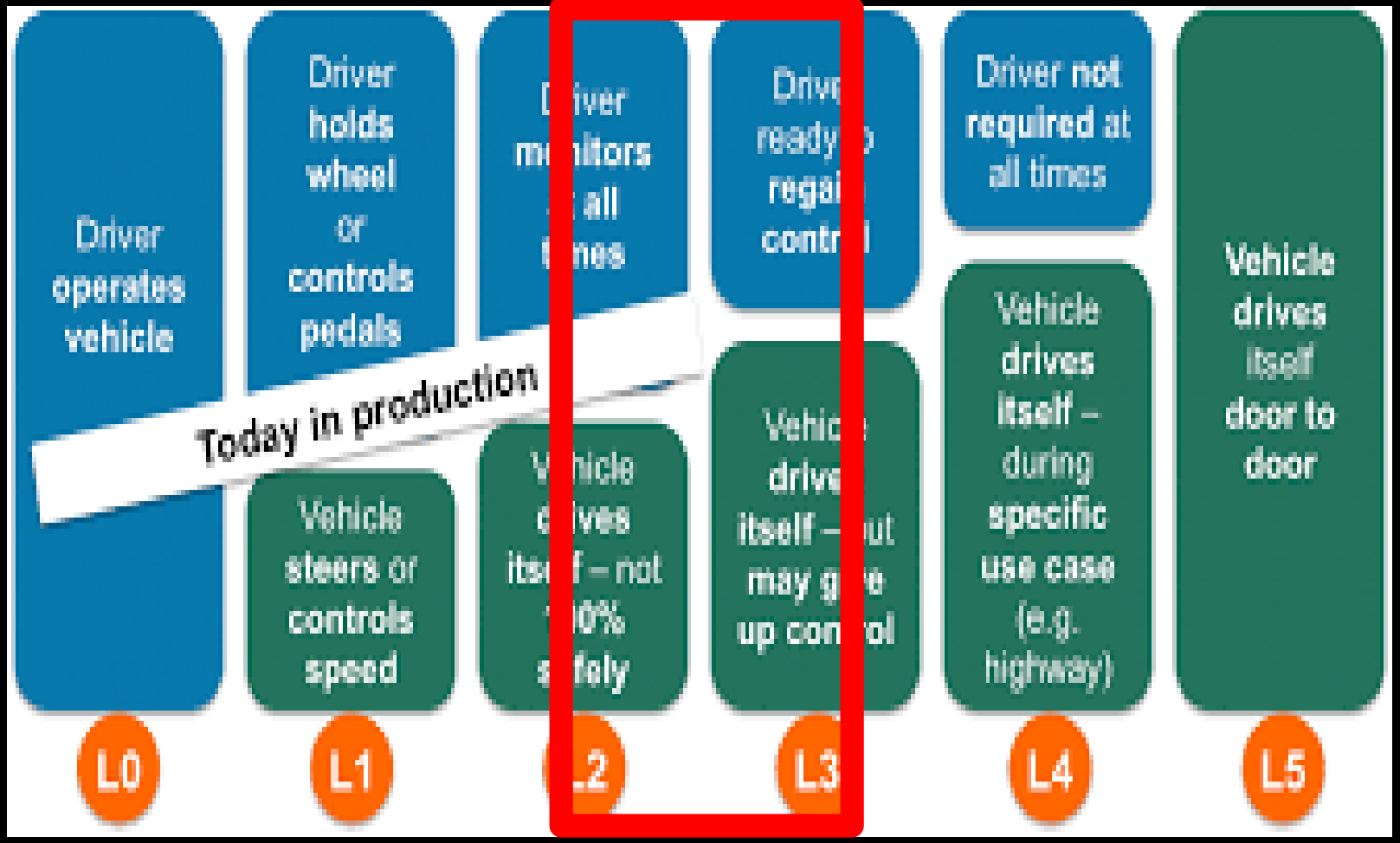
- Ability to respond quickly to control signals, and to apply great force smoothly and precisely
- Ability to perform repetitive, routine tasks
- Ability to store information briefly and then to erase it completely
- Ability to reason deductively, including computational ability
- Ability to handle highly complex operations, i.e., to do many different things at once.



- Ability to detect small amounts of visual or acoustic energy
- Ability to perceive patterns of light or sound
- Ability to improvise and use flexible procedures
- Ability to store very large amounts of information for long periods and to recall relevant facts at the appropriate time
- Ability to reason inductively
- Ability to exercise judgment

The MABA-MABA List

Let's Have a Look ...

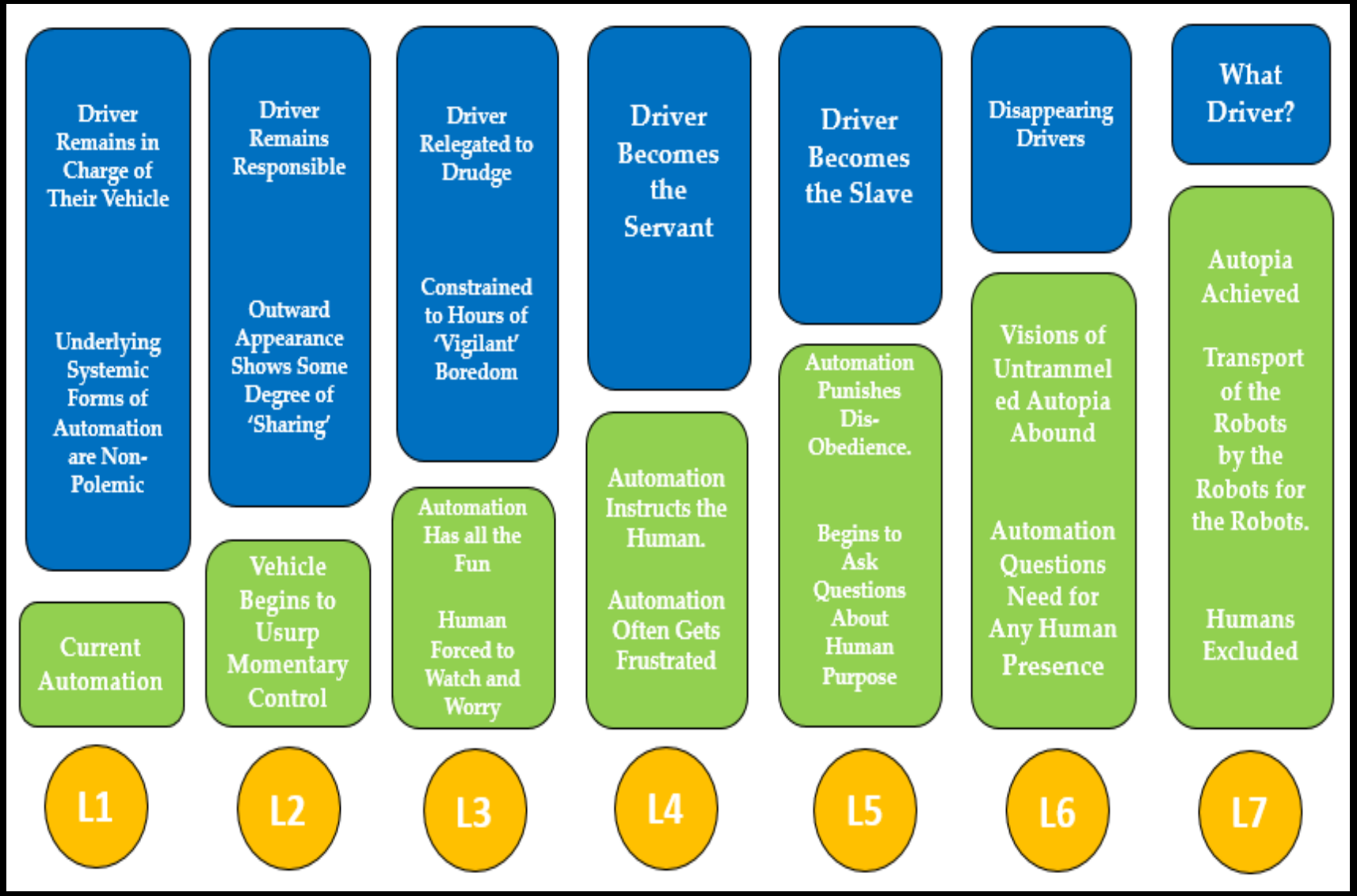


Here

The Current SAE Levels

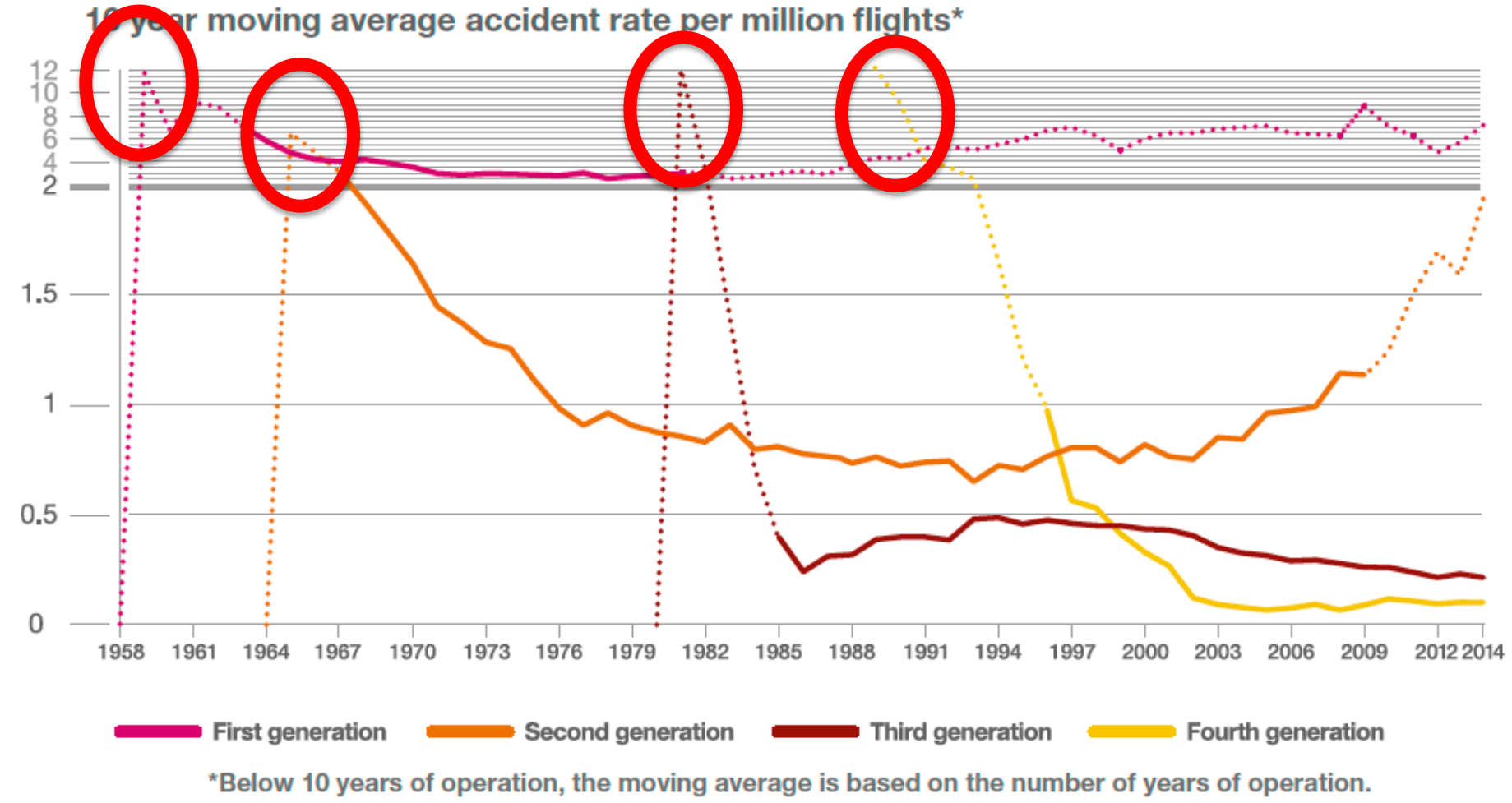
SAE level	Name	Narrative Definition	Execution of Steering and Acceleration/ Deceleration	*Monitoring* of Driving Environment	Fallback Performance of *Dynamic Driving Task*	System Capability *(Driving Modes)*
***Human driver* monitors the driving environment**						
0	**No Automation**	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a
1	**Driver Assistance**	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	**Au**	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/ deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
***Automat* *ystem* ("system") monitors the driving environment**						
3		the *driving mode*-specific performance by an *automated driving system* of all aspects of the dynamic driving task with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	**High Automation**	the *driving mode*-specific performance by an automated driving system of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	**Full Automation**	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

The Hancock List



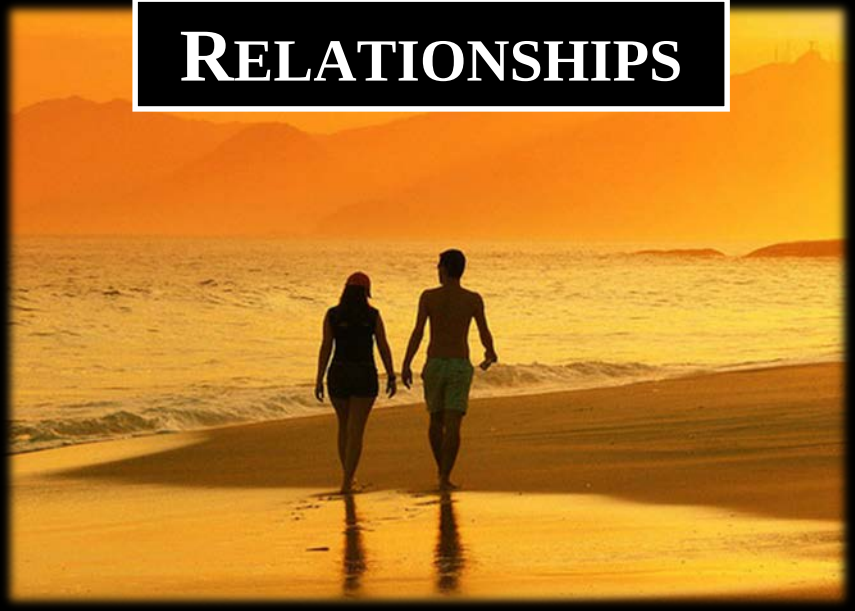

Let's Glimpse our Future

Upon Introducing New Technologies



Source: Airbus, 2015, With Thanks to: Michael Feary.

ARE THERE THINGS WE DON'T WANT TO AUTOMATE?



WHAT DON'T YOU WANT TO AUTOMATE?

*"Cows (either grazing in fields or housed in large sheds) **decide for themselves** when they want to be milked and **form an orderly queue outside** ... Some dairy parlours are now milking 24/7 without any human present."*

*"STUDENTS (either grazing in fields or housed in large sheds) **decide for themselves** when they want to be EDUCATED and **form an orderly queue outside** ... Some UNIVERSITIES are now INSTRUCTING 24/7 without any TEACHER present."*

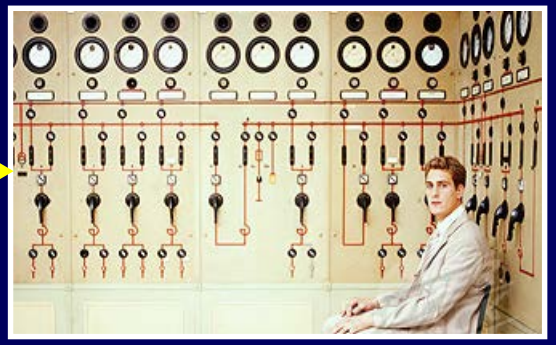
GRADUATE SCHOOL

Consider The Comparable Evolution of the Aircraft Pilot

Military

Hero **Authority** **Drudge**

Civilian

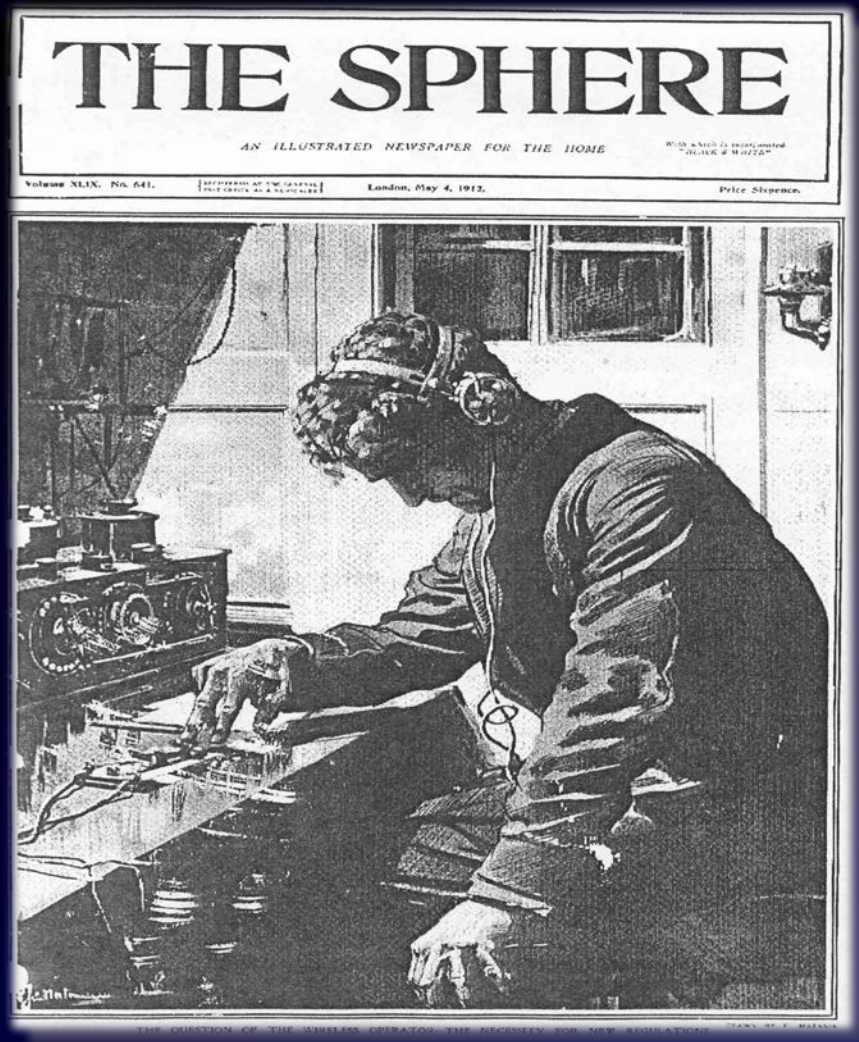


Pilots – Are They Are Becoming Extinct?

Or Simply Managers/Observers of Ever More Autonomous Systems.

Let's Consider Another "Skilled" Profession

The 'Apparently' Inevitable Problem of Vigilance



THE SPHERE

AN ILLUSTRATED NEWSPAPER FOR THE HOME

Volume XLIX. No. 641. London, May 4, 1912. Price Sixpence.

THE QUESTION OF THE WIRELESS OPERATOR: THE NECESSITY FOR NEW REGULATIONS

In Search of Vigilance

The Problem of Iatrogenically Created Psychological Phenomena

P. A. Hancock
University of Central Florida

To what extent are identified psychological processes created in laboratories? The present work addresses this issue with reference to one particular realm of behavior: vigilance. Specifically, I argue that the classic vigilance decrement function can be viewed more realistically and advantageously as an "invigilant" increment function. Rather than characterizing the transient decrease in detection capability that is evident on exposure to enforced monitoring as a diminishment in capacity, it may be more usefully seen as an appropriate scaling by the designated observer to adapt to the nonoptimal circumstances that he or she is forced to endure. This proposition emphasizes the dynamic response characteristics of the observer and locates the origin of the phenomenon and the onus for practical improvements in the design of operational displays with designers rather than apportioning blame for performance decrements to the operator. This perspective reinforces the recognition of a crucial presence of the necessary but often unrecognized external arbiter in the vigilance paradigm and the extrinsically imposed imperative to sustain attention. Explicit recognition of this fact also helps explain the stress involved with extended vigils. In identifying the traditional vigilance decrement as a form of iatrogenic disease, I argue that modern design of work systems should alleviate the need for either the acute or the chronic expressions of such enforced human monitoring activity. It is possible that the case of vigilance is itself representative of a modern propensity to create new psychological phenomena in the face of human exposure to modern, evolving technical environments.

Keywords: vigilance, sustained attention, iatrogenesis, displays, semiautonomous systems

als were unable to spot the enemy craft on their airborne radar displays (see Ditchburn, 1943; Warm, 1984). As a result, risky and expensive missions were going to waste as their targets below remained elusive in the cold Atlantic waters off of the north coast of Spain. More to the point, the war was being lost. However, consistent with the wartime emergence of useful applied psychological investigation, Norman Mackworth was commissioned to evaluate the reasons for and potential solutions to these detection failures. His subsequent monograph on this issue is surely one of the classics in all of applied experimental psychology (Mackworth, 1950).

What has not been previously articulated and explored in the vigilance literature is the proposition that the observed decrement function that motivates psychological research into vigilance is actually iatrogenic in nature. That is, the primary pattern of behavior that characterizes this area is actually a result of the conditions created initially by the contemporary system and display designers of these wartime years and then subsequently by experimenters like Mackworth himself, who essentially gave this aspect of human performance its label and its life (see also Buckner & McGrath, 1963). My purpose in the present work is to reconsider vigilance in light of this iatrogenic origin and to reconceptualize vigilance in terms of an adaptive adjustment by the observer to the stressful and externally imposed need to constrain what is normally the free-roving, self-directed, information-acquiring capacity of attention. The impetus for such a reexamination does not lie solely in the effort to recast psychological theory. Rather, it is a crucial pragmatic enterprise given the nature and evolution

Holland, J.F., Leary, J.J., & Sweeley, C.C. (1986). Advanced instrumentation and strategies for metabolic profiling. *Journal of Chromatography*, *378*, 3-26.


So it May not be as Much About
HOW we Automate but Whether …
We SHOULD Autonomize?
The Last Day of Operation of the World's Busiest Telegraph Office

The EVOLUTION From AUTOMATION to AUTONOMY

Automated systems are designed to accomplish a specific set of largely deterministic steps (often in a repeating pattern) in order to achieve one of a finite set of pre-defined goals.

Autonomous systems, in contrast, are generative; they learn and evolve through the input of operational and contextual information and thus their actions necessarily become more indeterminate across time.

What LIMITS do We set on AUTONOMY?

Precisely HOW and WHEN Do We Set Such Limits?

Hancock, P.A. (2017). Imposing limits on autonomous systems. *Ergonomics*, *60* (2), 284-291.

Automation: What we (Humans) Used to Do Ourselves

We are not just taking away work here. We are taking away TELETIC activity. These guys actually ENJOY their Job!!

Don't Some, or Even Many, Drivers ENJOY Driving?

Will There Be Persistent Problems of “Mixed Equipage?”

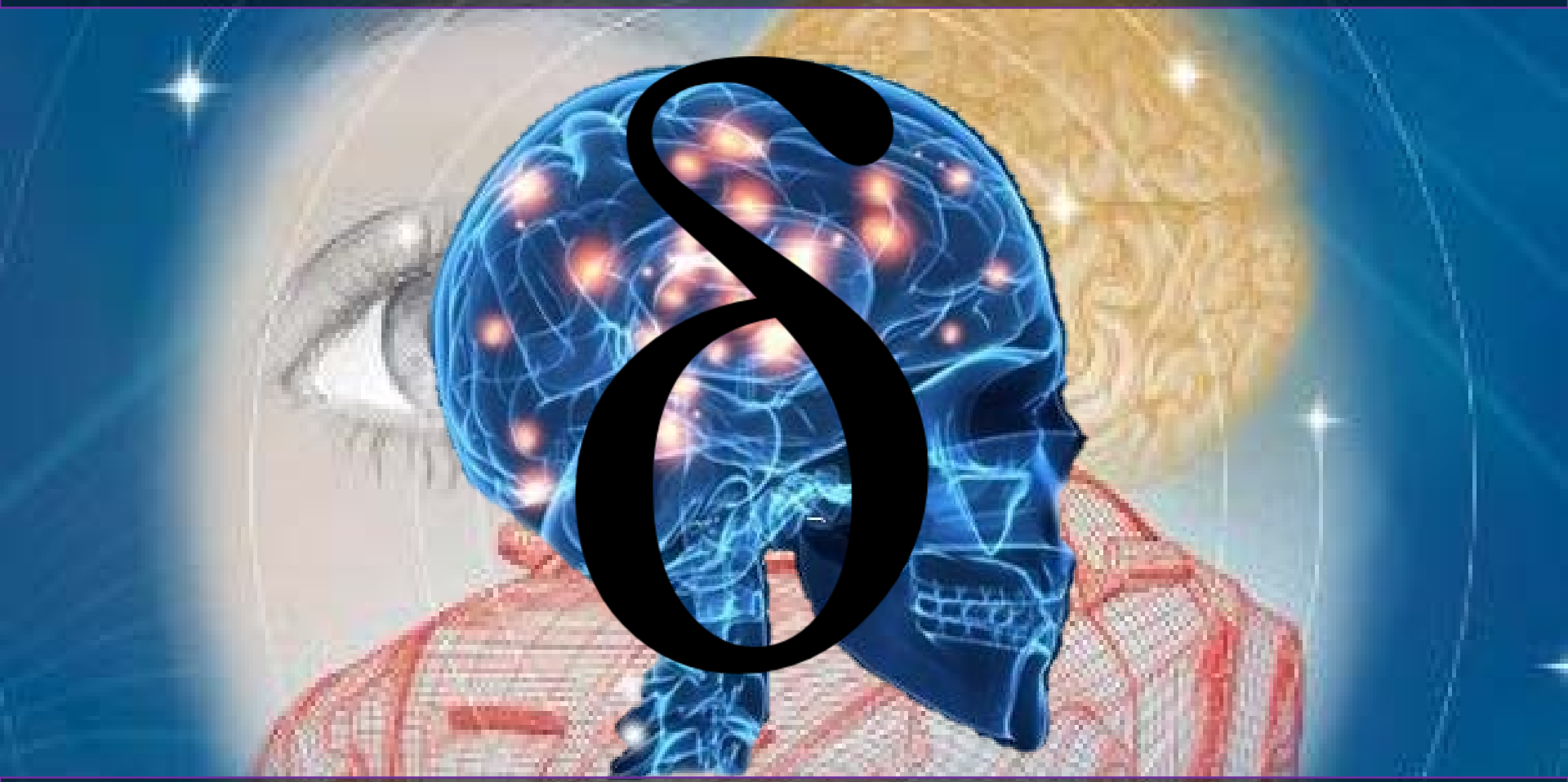
Always a Last Bastion for Petrol-Heads to Practice their Arcane Rites?

Driving has Often Been the first full expression of personal “Freedom” (Driving Solo) and its Last expression (Removing Keys from an Aging Parent).

The Development Needs to Be a HUMAN-CENTERED not a TECHNO-CENTERED Evolution

Currently we are Being DRIVEN by What is Possible, Not What is Advisable

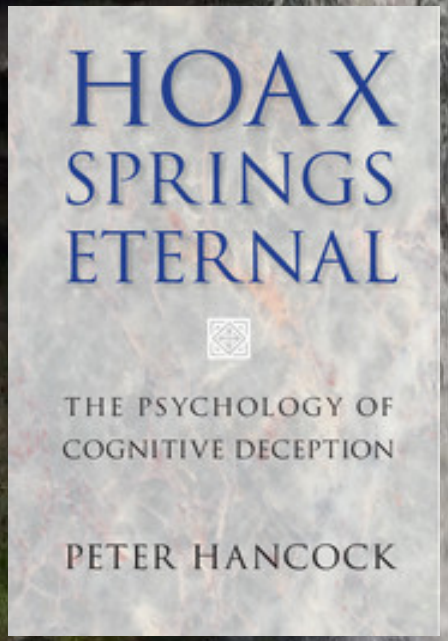
WHAT THEN IS DELTA?

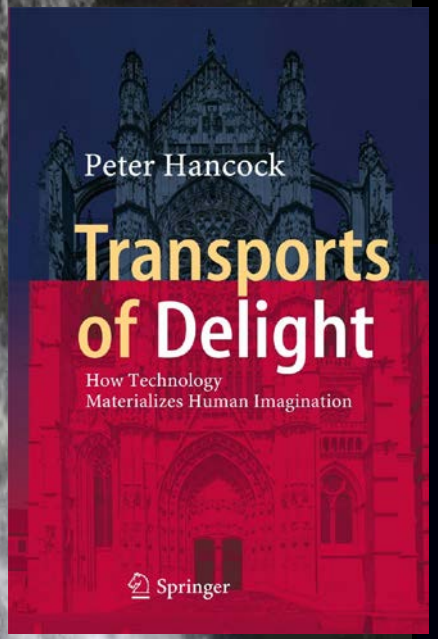


THE DESIGNED ELIMINATION OF TRAFFIC ACCIDENTS

DELTA: Makes a Difference

ALL Patterns we experience are ONLY Sensory-Cognitive APOPHENIA





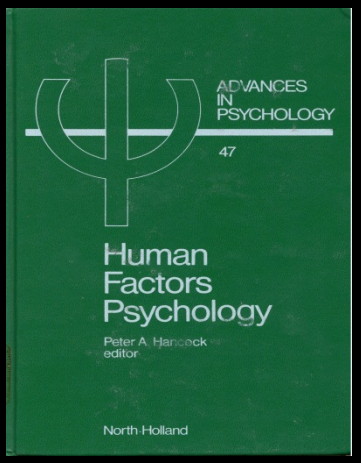
"Life's a jest and all things show it, I thought so once and now I know it."

(John Gay's Epitaph).

P.A. Hancock, D.Sc., Ph.D.

407-823-2310
Peter.hancock@ucf.edu
www.peterhancock.ucf.edu

Thank You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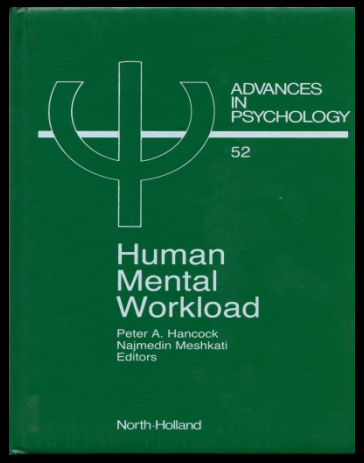
47
Human Factors Psychology
Peter A. Hancock editor
North-Holland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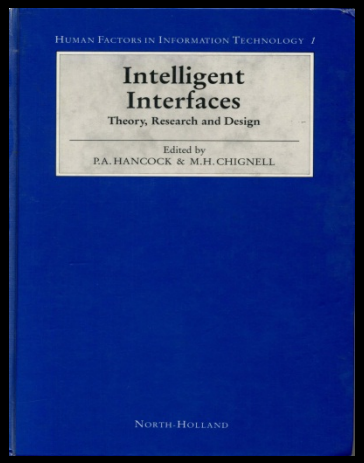
52
Human Mental Workload
Peter A. Hancock
Najmedin Meshkati
Editors
North-Holland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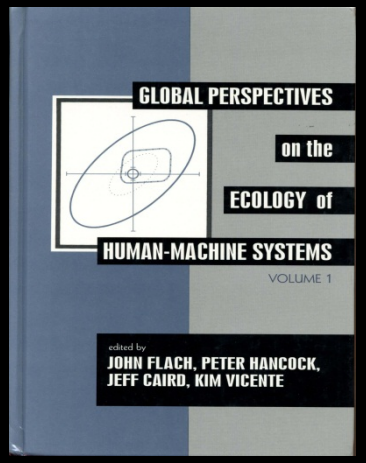
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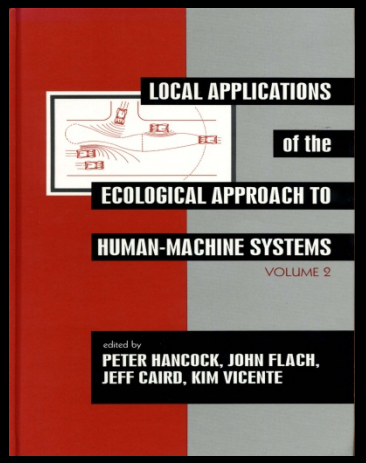
VOLUME 1
edited by
JOHN FLACH, PETER HANCOCK, JEFF CAIRD, KIM VICENTE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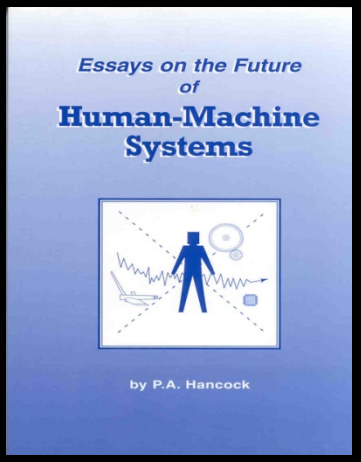
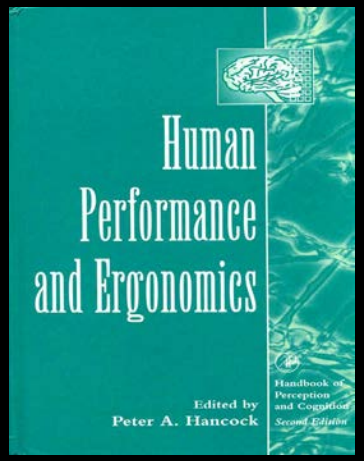

Essays on the Future of
Human-Machine Systems
by P.A. Hancock


Human Performance and Ergonomics
Handbook of Perception and Cognition
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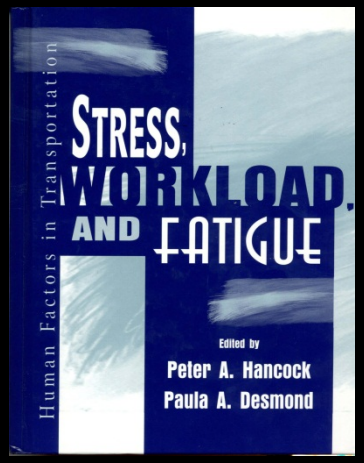
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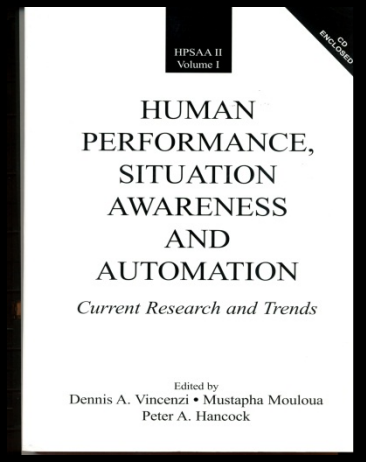
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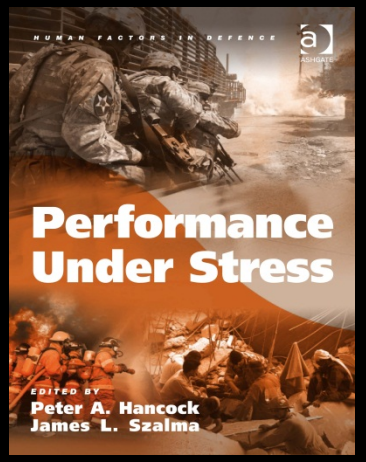
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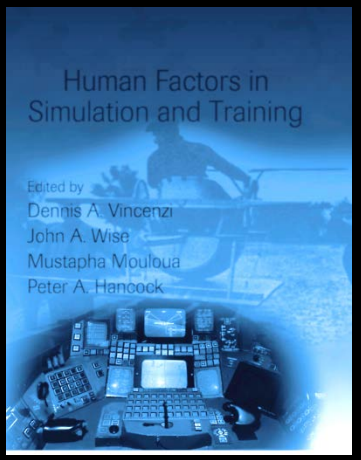
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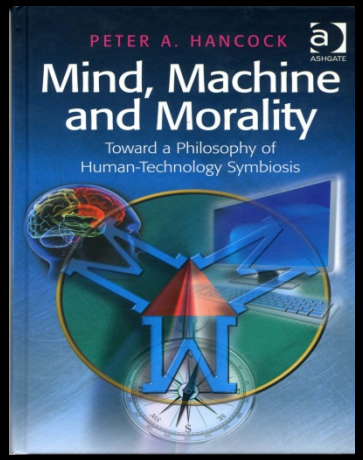
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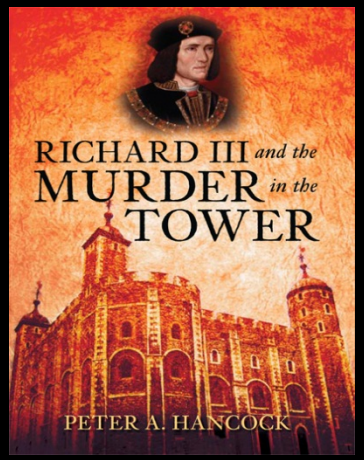
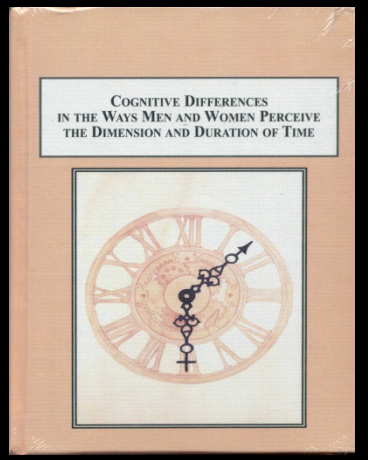
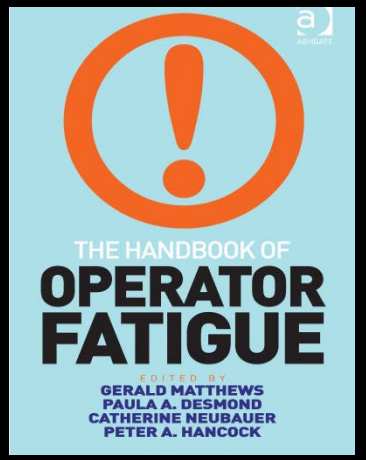
Mind, Machine and Morality
Toward a Philosophy of Human-Technology Symbiosis
ASHGATE


RICHARD III and the MURDER in the TOWER
PETER A. HANCOCK


COGNITIVE DIFFERENCES IN THE WAYS MEN AND WOMEN PERCEIVE THE DIMENSION AND DURATION OF TIME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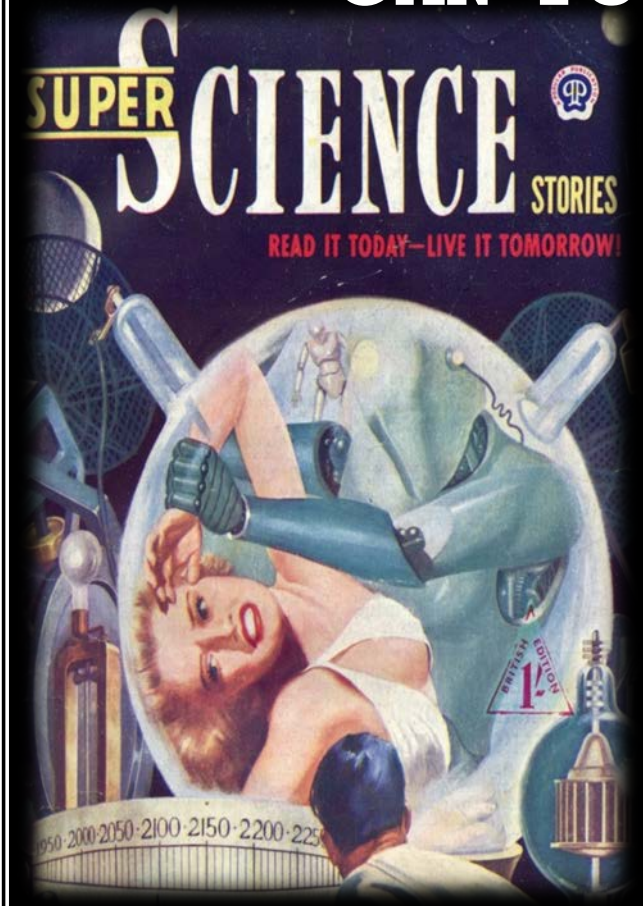
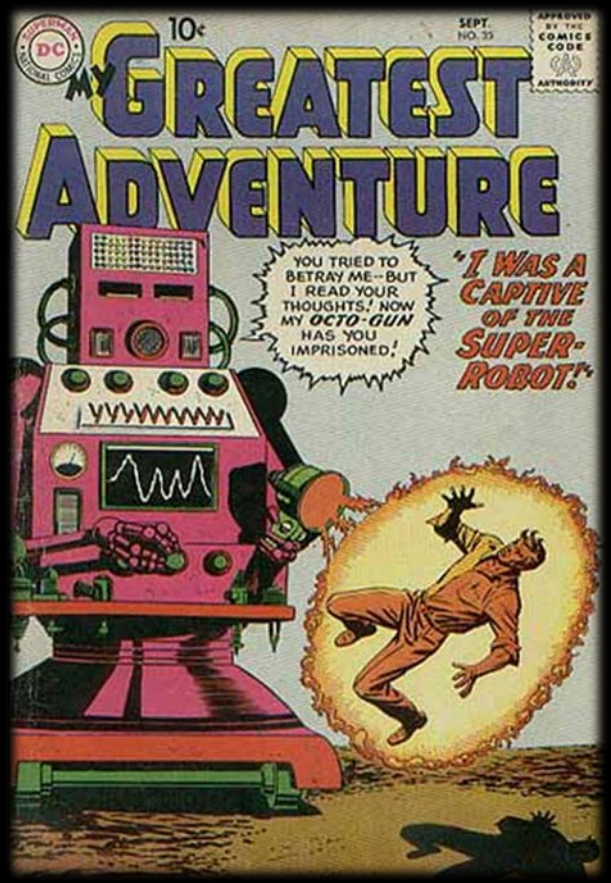
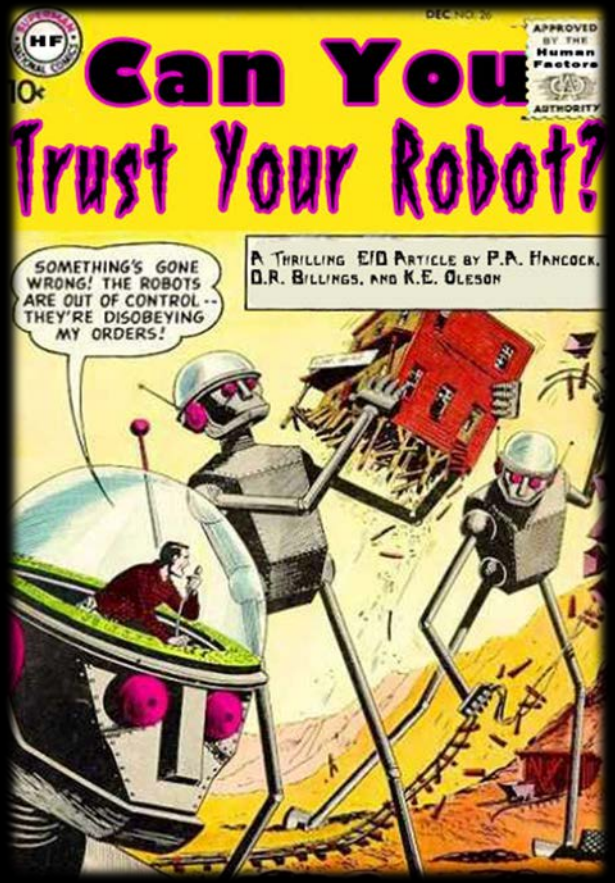
"Can You Trust Your Robot?"







Domination is a Human NIGHTMARE, not a Machine DREAM

(A Part of our Flawed Propensity to Attribute 'Agency'

Hancock, P.A., Billings, D.R., Olsen, K., Chen, J.Y.C., de Visser, E.J., & Parasuraman, R. (2011). A meta-analysis of factors impacting trust in human-robot interaction. *Human Factors,* 53 (5), 517-527.

Time Video

Surely We Have both a MORAL and a PRAGMATIC Imperative to Consider PURPOSE Before PROCESS

Automation: how much is too much?

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The headlong rush to automate continues apace. The dominant question still remains whether we can automate, not whether we should automate. However, it is this latter question that is featured and considered explicitly here. The suggestion offered is that unlimited automation of all technical functions will eventually prove anathema to the fundamental quality of human life. Examples of tasks, pursuits and past-times that should potentially be excused from the automation imperative are discussed. This deliberation leads us back to the question of balance in the cooperation, coordination and potential conflict between humans and the machines they create.

Practitioner Summary: The reason for this work is to examine how much automation is too much. The investigational form is synthetic in nature. The major finding is – it depends? Each design decision of practitioners as to what to automate and when is, therefore, critical and fateful.

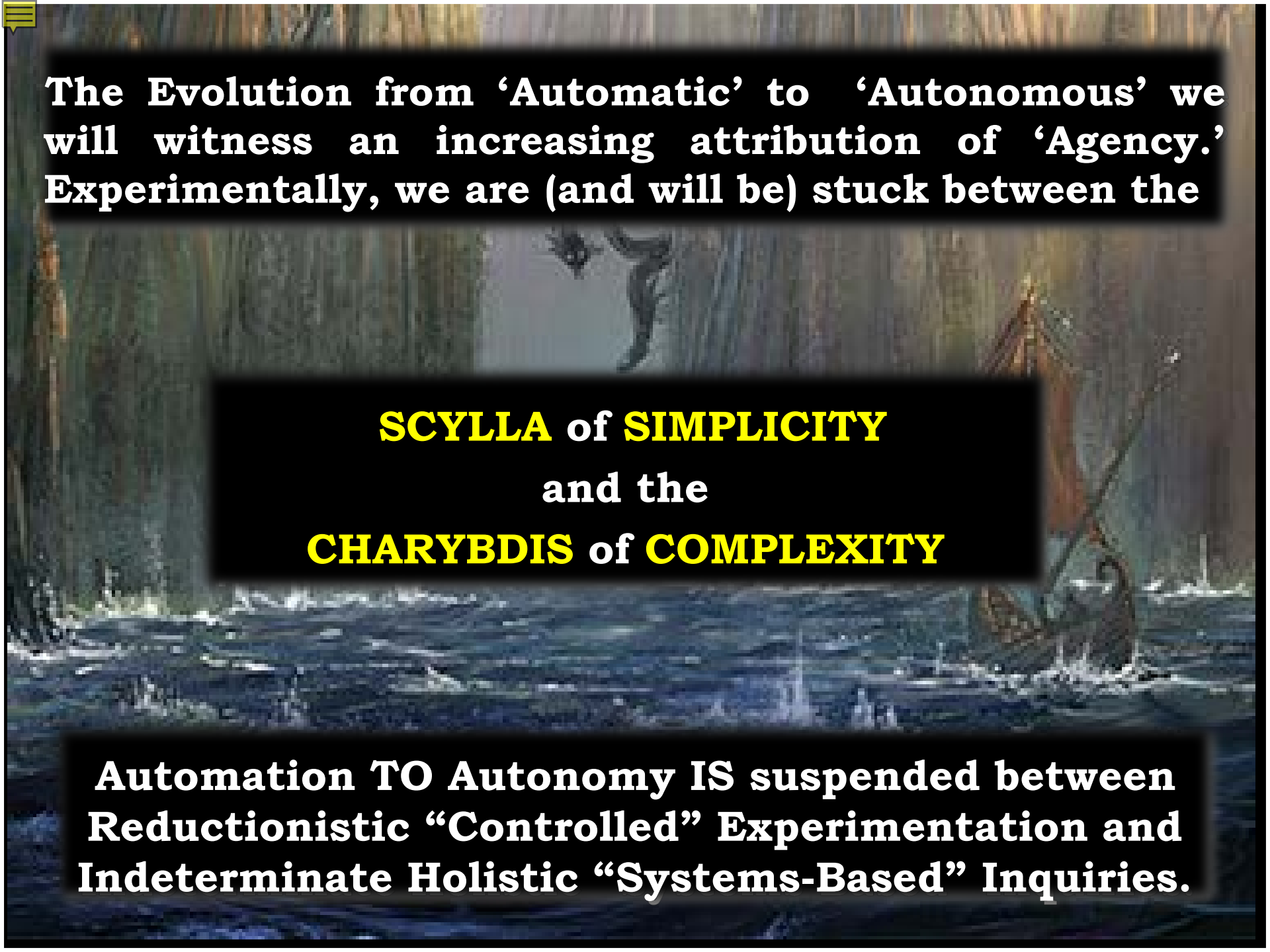
Hancock, P.A. (2014). Automation: How much is too much? Ergonomics, 57 (3), 449-454.

Gibson/Crooks, Rashenvsky, Lewin

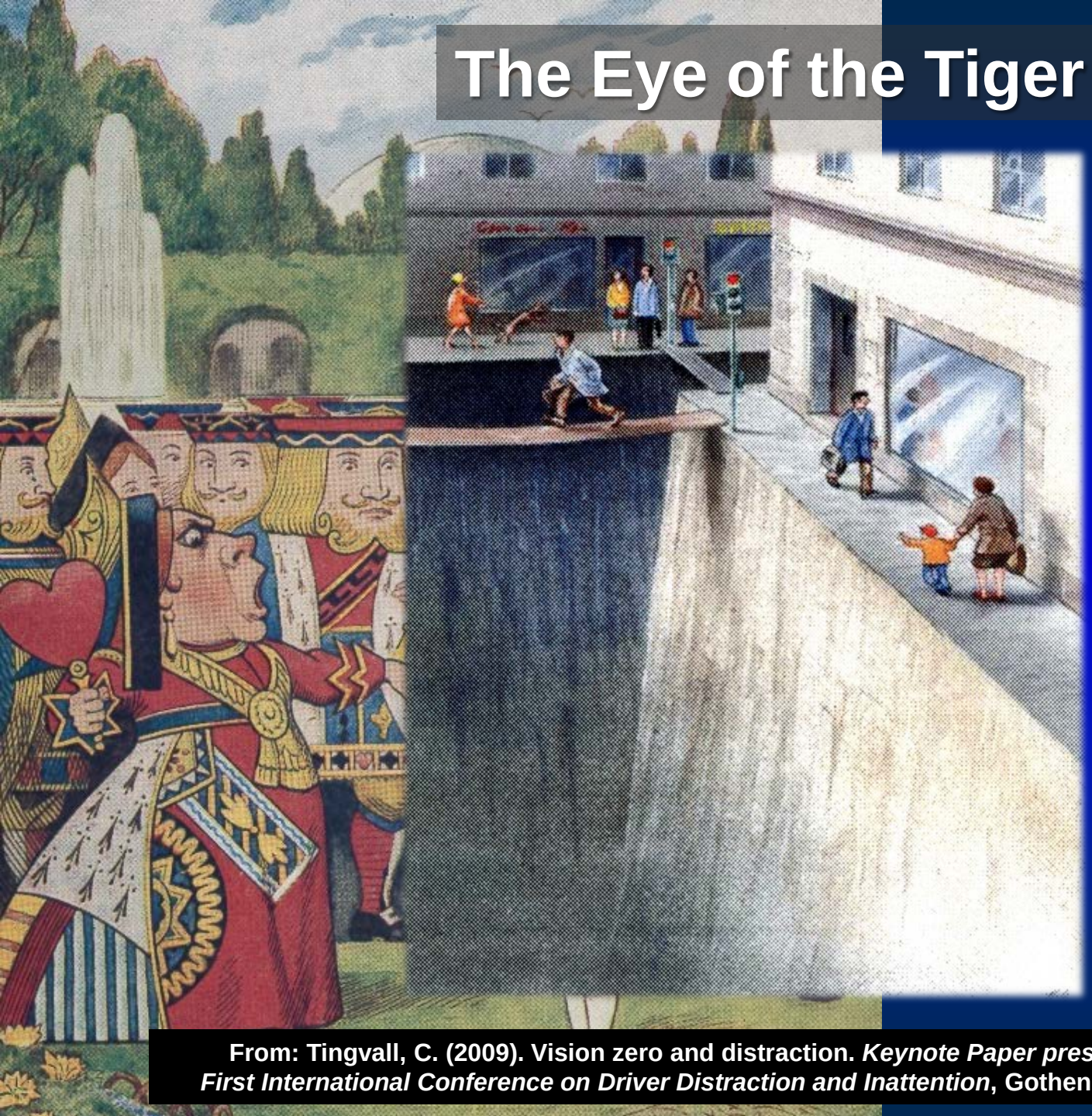
Mixed Equipage

complications arising from interactions between human drivers and driverless cars cannot be solved with current representational models for decision-making and coordination. We analyzed an example of human driving in roundabouts through the ecological dynamics framework, which considers that drivers' exploratory activities rely on the utilization of affordances, rather than on the internal processing of information, which is currently the default assumption guiding driverless-car design. Driverless-cars present a remarkable opportunity for developing new technology to improve human interaction with the world. Ecological approach could be used to investigate how digital driving landscapes may be closely tailored to the drivers' needs through their own driving activities.

?

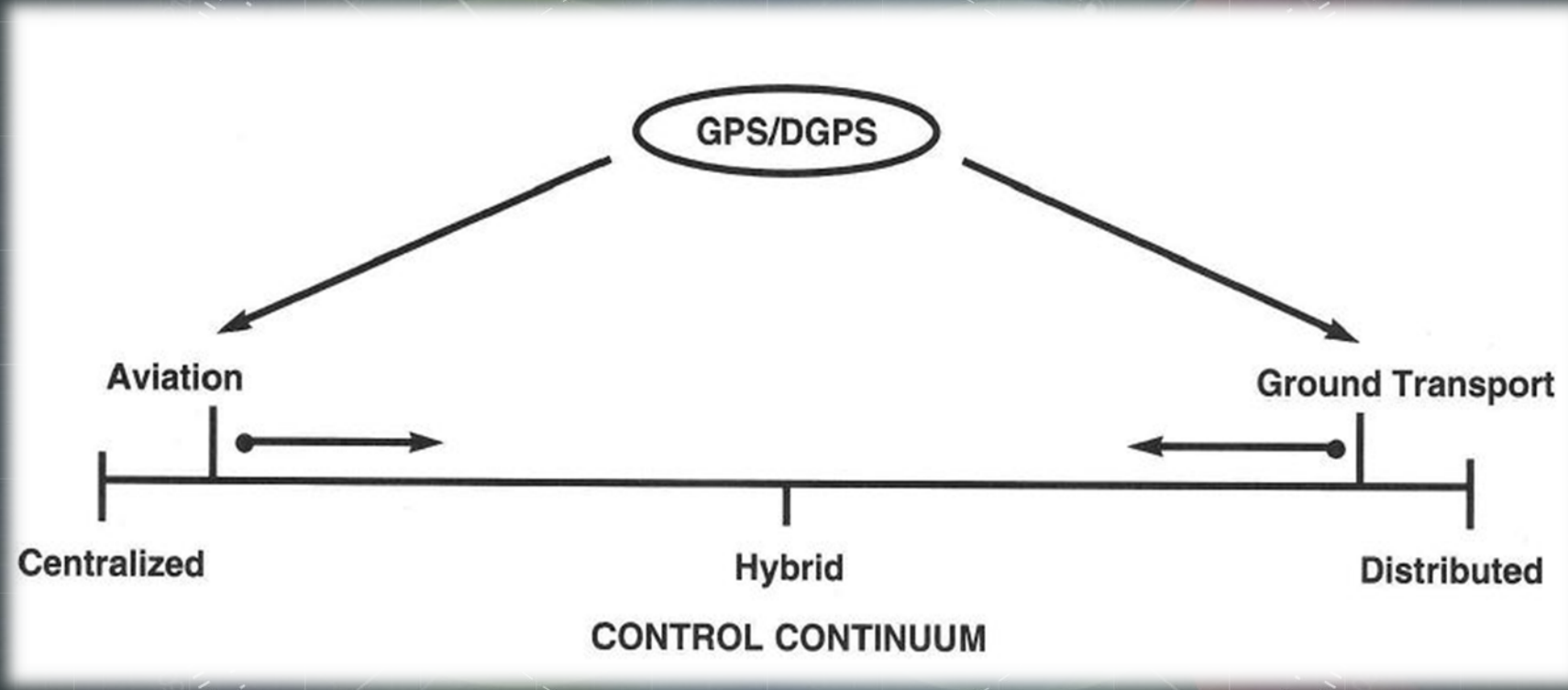

The Evolution from ‘Automatic’ to ‘Autonomous’ we will witness an increasing attribution of ‘Agency.’ Experimentally, we are (and will be) stuck between the
SCYLLA of SIMPLICITY
and the
CHARYBDIS of COMPLEXITY
Automation TO Autonomy IS suspended between Reductionistic “Controlled” Experimentation and Indeterminate Holistic “Systems-Based” Inquiries.

The Eye of the Tiger



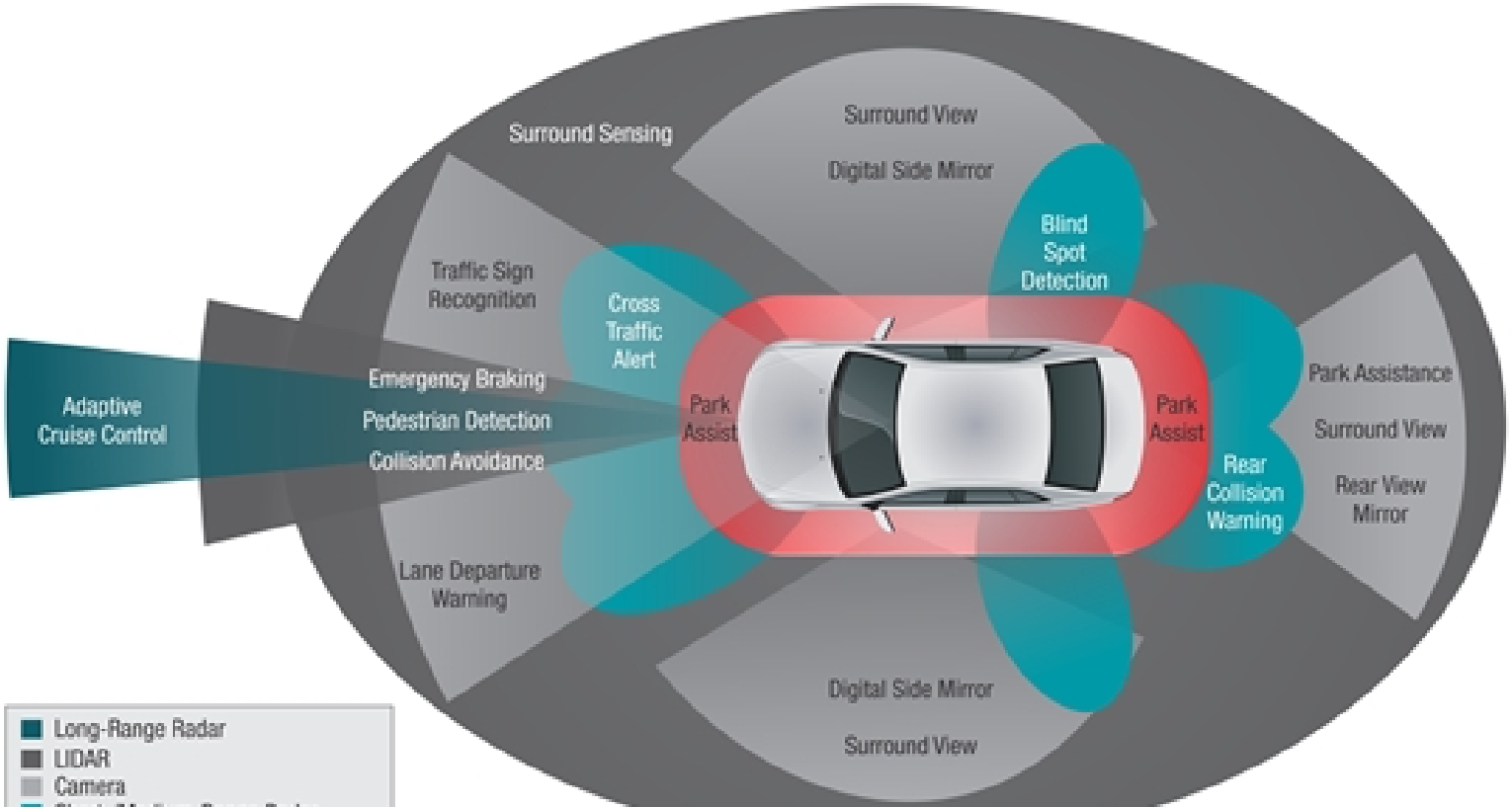
From: Tingvall, C. (2009). Vision zero and distraction. *Keynote Paper presented at the First International Conference on Driver Distraction and Inattention*, Gothenburg, Sweden.

Are Hybrid Control Architectures Necessarily a Step Along the Road to Untrammeled Autonomy?



Hancock, P.A. (1996). On convergent technological evolution. *Ergonomics in Design*, 4 (1), 22-29.

Driver-Centered vs Machine-Centered?



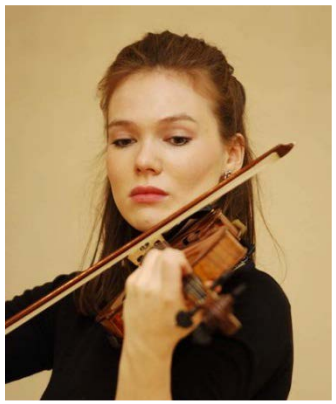
But

Are We Actually Short of People?


SNL

Lots of Human Activities are Characterized By Hours of Boredom: Moments of Terror

Athletes



Musicians

Actors

Pilots

Firefighters

Paramedics

Soldiers

Researchers

Hours, Days, Weeks, Months even Years of Preparation for Hours, Minutes, even Mere Seconds of Performance.

THE HEDONOMIC DIMENSION

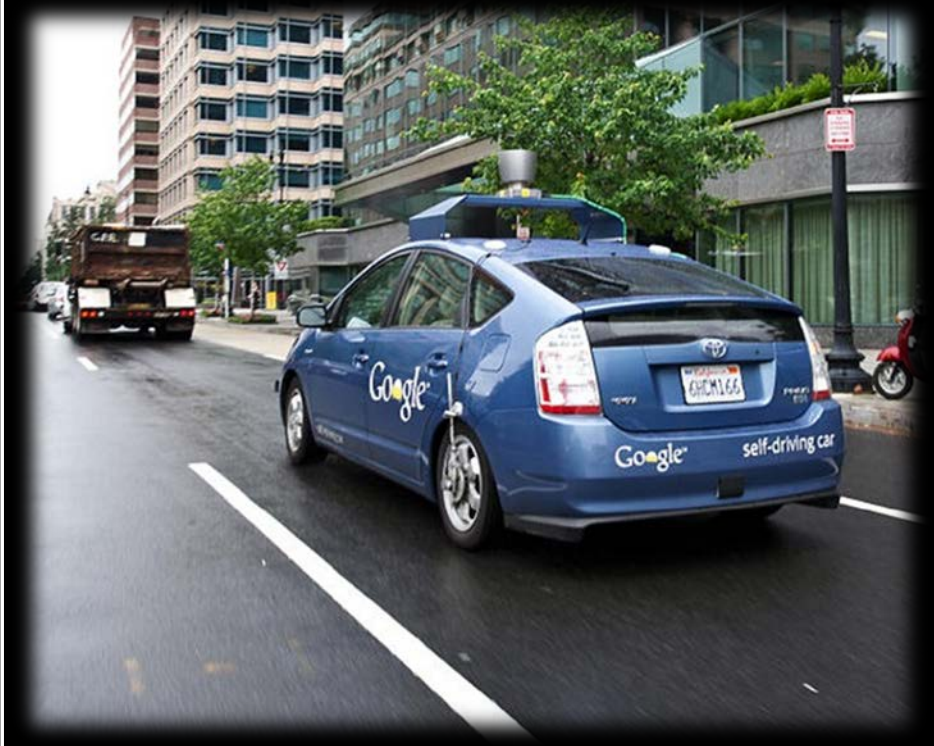
Some People LOVE Driving … Others LOVE Their Car!

How Much Fun is NASCAR in AUTOMATED Vehicles?

But Then Again How Much Fun is NASCAR Anyway?

The Issue of Attributed "Agency" – And How Easily Love Can Turn to Hate

More Than a “Box on Wheels”
More than “Origin to Destination”



Vehicle Control Expresses the “Will to Power” (Literally Sometimes). Automatic Vehicles place Restrictions on that Freedom. How Long Before ‘System-Wide’ Control Sub-Optimizes Individual Aspirations? How Can we then ever Optimize the “Commons” of Driving?

Nihil Sub Sole Novum – With Thanks to Neil Lerner

When we Look to Change the Vehicle We are Also Changing Society …

On What PRINICIPLE are we making such change. Or is it all on PRINCIPAL Alone.

The Role of Advanced Automotive Technology in Defeating Evil – The Standard Narrative

Mimetic Principles

1) Physical Replication (Mimesis)

2) Biological Principles (Biomimesis)

"Nature tends to copy solutions that work, and if aeons ago the ancestors of our visual system (for example) managed to solve the Many Properties problem, it would not be entirely surprising to find that the later linguistic systems simply copied their solution. If this were so, then the distinction between reference and predication reflects an even deeper and older architectural feature of the neural organization of our sensory systems ."

Clark, A. 2000. *A Theory of Sentience*. (pp 73-74), New York, NY: Oxford University Press.

3) Technological Orthotics (Technobiomimesis)

Are They Each Equipped with Volvo’s Collision-Avoidance?

Biomimetic Principles

Intentionally Forming 'A Predator' Shape – or is this a Case of Cognitive 'Apophenia?'

Non-Collisions on the Basis of Adiabatic Principles?

Biomimesis - Predator-Prey Relations

Also Happen On the Road

Are Such Predator's … Pathogen's in the Traffic Stream?

Whose Symptomatology Include … "Road Rage" "Tailgating" etc.

The Sheepdog and the Japanese garden

Metaphor for Interaction with Nascent Autonomous Systems (e.g., Robots).

Metaphor for Context-Shaping of our Environment (e.g., sustainable design).

Hancock, P.A. (1997). The sheepdog and the Japanese garden. In: P.A. Hancock. *Essays on the Future of Human-Machine Systems.* Banta, Eden Prairie, MN.

Technobioimetic Principles

Technobiomimetic Principles

Are They:

i) Purely metaphorical?

ii) Conveniently Analogical?

iii) Direct ReplicationS?

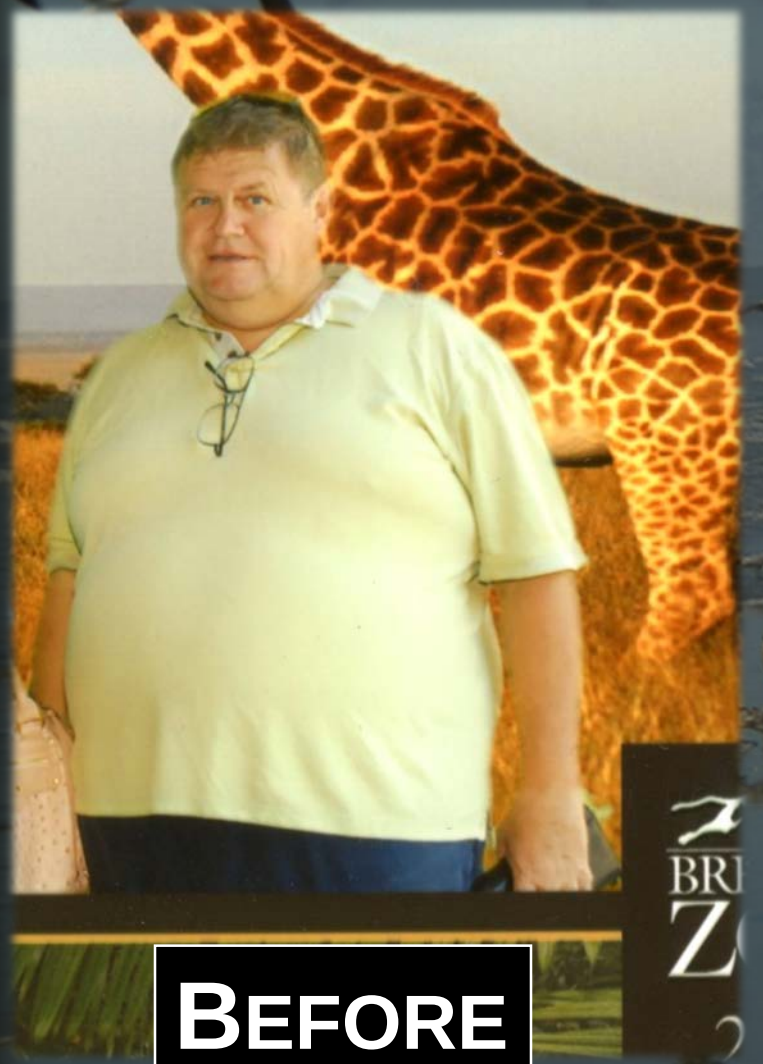
Such Principles Allow us a Degree of Precedence and Prescience in an ever-more complex world.

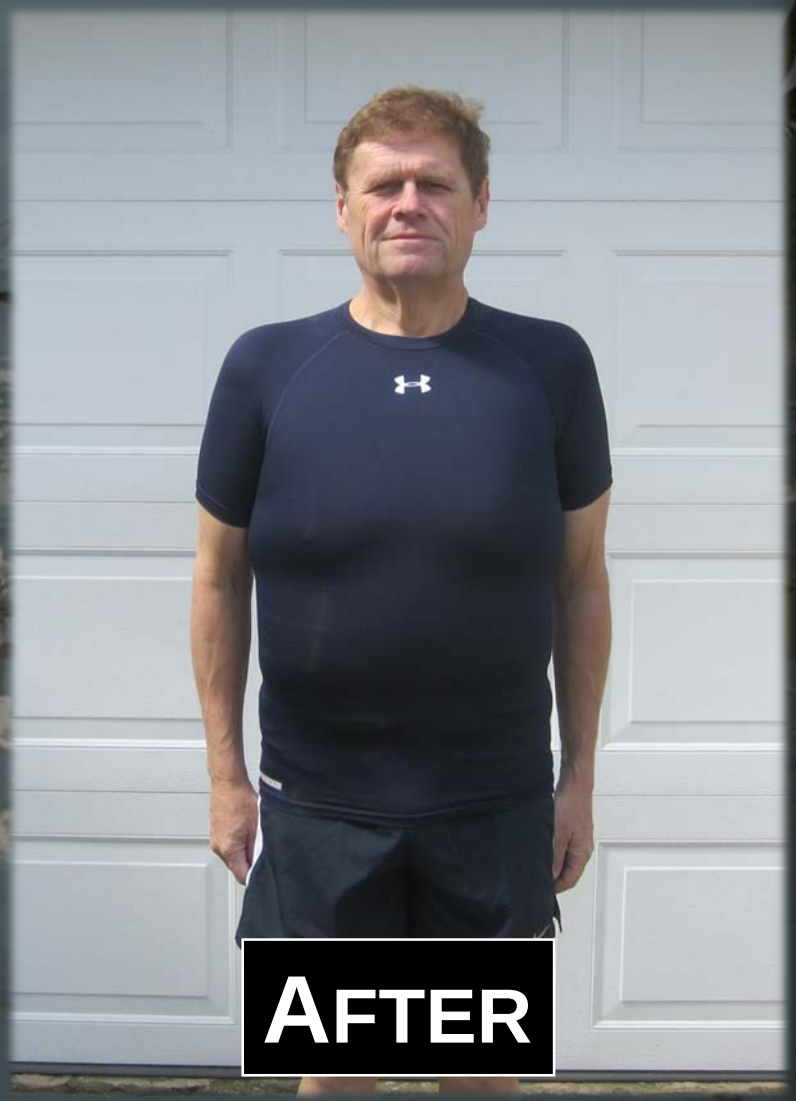
The Continuing Issue of Optimality and Change.

So, Car Crashes Can Have Strange Outcomes

The Hancock Car Crash, April 14th, 2010 [98th Anniversary of the Titanic's Sinking: To the Exact Hour!]. This coincidence Caused me to Think. So, in the Emergency Room I set a Goal …

About Time and Change, so





Yet My Conclusion is That: ALL Time is Delusion and all Change is Illusion!

The Humans Are Dead

What Dreams May Come?

WE are NOW engaged in a Great 'Civil' War. Do You WORK for TECHNOLOGY, or, Does TECHNOLOGY WORK for YOU?

Transportation (Cars) are perhaps the Critical Battleground of this War.

Not CAN we Automate but SHOULD WE automate?
However, That Train Has (Already) Left the Station.

If so, is HOW We automate Now the Best-Worst Option?

Technobiomimetic Principles appear to Hold the Best Promise.

Distracted Driver Runs Into Canterbury Cathedral