Distraction: Friend or Foe?

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Traditional Paradigm for Studying Distraction

1. Cars are *mechanical* devices

2. These mechanical devices are *consequential* and *demand attention*

3. Driving involves *control* of a mechanical system
Radical New Paradigm

Cars are a collection of a dozen screens
Cars as Screens

- The 12 screens of a car
  - Windshield
  - Rear window
  - Four side windows
  - Rear view mirror
  - Two side view mirrors
  - Dashboard
  - Center panel
  - (sometimes) Personal device
Radical New Paradigm

Psychology of driving = Psychology of screens

Welcome to Screen User Assessment 2013
The Psychology of Screens

Distraction vs. Attention
Distraction vs. Attention

- Understanding cars as *dangerous machines* leads to a focus on *distraction*
- Understanding cars as *screens* leads to focus on *attention*
- Attention is a broader concept than distraction
  - Not *a priori* normative
  - Controlled vs. automatic
Unpacking Attention

- Three levels of attention
  - Level 1: Selective exposure
    - Not always “selected”
  - Level 2: Selective processing
    - Not always “selected”
  - Level 3: Selective influence
    - Not always “selected”

- The three levels of attention are not independent
This Parallels …

Situation Awareness!

Knowing what is going on in order to know what to do
Three Levels of Situational Awareness (SA)

- Knowing what is *going on*
  
  **Level 1: Perception:** What information is *relevant*?
  Selective exposure
  
  **Level 2: Comprehension:** What does (1) *mean to me*?
  Selective processing

- Knowing *what to do*
  
  **Level 3: Projection:** What should I *do* given (2)?
  Selective influence

- The three levels of SA are not independent
  
  - Each influences the other
Can Drivers Have Situational Awareness?
Screen Multitasking is Ubiquitous

- Average college student use 3 media simultaneously whenever they are using media
  - Top 25% (and growing): 4 or more media at one time
  - Bottom 25%: 1.8 or less media at one time

- In-the-moment use of multiple screens:
  - Always hurts perception
  - Can hurt cognition and perception
What About *Chronic* Multitasking?

- “When it really matters, I don’t multitask”
- “Multitasking doesn’t bother me because I do it so often”
- “Young brains are able to multitask”
Multitasking and Level 1

- Count the passes
Results

- High SMs were more likely to see the gorilla

**BUT .....**

- Low SMs were more likely to get the number of passes correct
- Low SMs look where they are supposed to look
- High SMs look all over
  - Not an attention “deficit,” but a misallocation
- High SMs have a Level 1 (perception) problem
Multitasking and Level 2

- You will see a group of rectangles twice
- IGNORE the blue rectangles
- Remember the red rectangles
- Say if one of the red rectangles changed orientation
200 ms
Results

![Graph showing performance (K) against number of distractors for LMM and HMM. Performance decreases as the number of distractors increases.](image-url)
Results

- High SMs have Level 2 (comprehension) problem
  - Somewhat Level 1
A Related Study

- High and low SMs do a telephone job interview while in a car simulator
- High SMs drive better (still badly) BUT
- High SMs do worse on the job interview

WHY?

- Voice input/output is much more engaging than bland screen
  - Cell phone conversation is the *primary* task
- High SMs are more “distracted” by the road!
Multitasking and Level 3

- Participants given 30 minutes to answer the following GRE question:
  - “The luxuries and conveniences of contemporary life prevent people from developing into truly strong and independent individuals.

- Other people are (ostensibly) also writing an essay

- At pre-determined intervals, relevant/irrelevant items are displayed on the news feed

- Assessment of essay (Six point rubric)
  - Organization
  - Coherence
Prompt: “The luxuries and conveniences of contemporary life prevent people from developing into truly strong and independent individuals.”

Write a response in which you discuss the extent to which you agree or disagree with the statement and explain your reasoning for the position you take. In developing and supporting your position, you should consider ways in which the statement might or might not hold true and explain how these considerations shape your position. Use facts and references to support your position.

This is my essay response...
Prompt: “The luxuries and conveniences of contemporary life prevent people from developing into truly strong and independent individuals.”

Write a response in which you discuss the extent to which you agree or disagree with the statement and explain your reasoning for the position you take. In developing and supporting your position, you should consider ways in which the statement might or might not hold true and explain how these considerations shape your position. Use facts and references to support your position.
Results

- Irrelevant side information hurts high SMs
  - Much worse essays when content is irrelevant
  - This is the norm for teens and increasingly all drivers!
- High SMs have Level 3 problems
Summary of Situation Awareness

- High SMs are growing percentage of the population
- High SMs are deficient at ALL aspects of Situation Awareness
- High SMs don’t have a primary task!
Why Do High SMs Have Sit. Aware. Problems?
Understanding Automobile Intelligence and Situational Awareness (SA)
Intelligence, Situation Awareness, and Generations of Screens/Cars
Four Generations of Screen Intelligence

1. User does everything (line editor)
2. Intelligence is hidden (GUI; auto spell check)
3. Incomplete intelligence is overt (voice user interface)
4. Complete intelligence (filters and full-blown agents)
Automobiles: Generation 1

- No automation/intelligence
- Situation Awareness concern is *perception*
  - Immediate distractions (alerts)
  - Long-term distractions (infotainment)
  - Visibility of functions
  - Visibility of roads
- This concern persists in first three generations
Automobiles: Generation 2

- *Hidden* automation/intelligence
  - Anti-lock brakes
  - ESP
  - *Drivers don’t need to know about this intelligence, especially not in real time*

- Situation Awareness concern is *risk homeostasis*
  - Implicates all three levels
    - Perception: Driver pays less attention
    - Comprehension: Driver doesn’t think very hard
    - Prediction: Drivers reacts more slowly and casually

- *Little risk homeostasis in hidden automation*
Automobiles: Generation 3

- Partial and Present Automation/Intelligence
  - *Full automation part* of the time
    - Automated driving some of the time; manual at other times
  - *Partial automation all* of the time
    - There are certain intelligent functions that work all of the time
Situation Awareness and Generation 3

- Full autonomy part of the time
  - *Acquiring* Situational Awareness when none exists
  - Challenges at all three levels
    - Perception
      - Desire to look at terminated task
    - Comprehension
      - It’s raining?!
    - Prediction
      - Framing is based on previous task
      - Affect influenced by previous task
- Partial autonomy all of the time
  - Risk homeostasis is at issue
Automobiles: Generation 4

- Complete Automation/Intelligence
- No situation awareness issues
- Media providers’ dream
  - They sell attention
The Generations of Automotive Intelligence

- Complete Intelligence
- Partial Intelligence
- Hidden Intelligence
- No intelligence

Generation

Trust

1 2 3 4
Diversity of Screens and Situational Awareness
Diversity of Screens

- **Size**
  - Larger screens draw more of all three levels

- **3D vs. 2D**
  - Greater exposure for 3-D
    - Dashboard and center panel are 2D but can be 3D
    - Not clear for comprehension and prediction

- **Resolution**
  - Greater exposure and easier comprehension with higher resolution
    - Dashboard and center panel are very high-resolution
    - Other screens affected by dirt
  - Not clear for prediction

- **Positioning**
  - Greatest exposure to screens facing front; not clear for comprehension and prediction
Screen User Psychology vs. Driver
Elaborating Screen Psychology: 1

*From:* Drivers want to pay attention; interfaces should not distract

*To:* Drivers do *not* want to pay attention; cars have to fight for attention

Examples:

1. When eyes linger on center panel, show view from windshield
2. Show dangerous obstacles on side window
3. Put critical content where driver attention is
Elaborating Screen Psychology: 1

*From:* Focused attention is Job 1 for the driver

*To:* Situation Awareness is Job 1 for the *car*
  - Perception
  - Comprehension
  - Planning

Examples:

1. “Please check your mirrors”
2. “It’s raining outside and the roads are slippery”
3. “There’s much more traffic than usual”
Change in Approach 3

*From:* Voice is replacement for visual

*To:* Drivers use screens continuously and simultaneously

Examples:

1. All screens are dynamic; “deserve” constant attention
2. Level 1 tracking is important but insufficient
Change in Approach 4

From: Drivers use interface for discrete acts

To: Drivers love speaking, listening, looking simultaneously

Examples:

1. All screens are dynamic; “deserve” constant attention
2. Level 1 tracking is important but insufficient
3. Audio I/O is not replacement
Change in Approach 5

From: Mental models are hardware-oriented

To: Mental models are software-oriented

Examples:
1. Create mental models of how car software works
2. Support different mental models for different screens
Summary:
Psychology of Cars = Psychology of Screens

- Cars are screens
  - Not mechanical devices
- Driving is a casual experience
  - Not consequential
- Driving involves consumption of screens
  - Not control of machines
- Forget “distraction”
  - General attention and situation awareness are more important
Final Plea

- I *desperately* need outstanding Ph.D. students