



# Human Information Processing

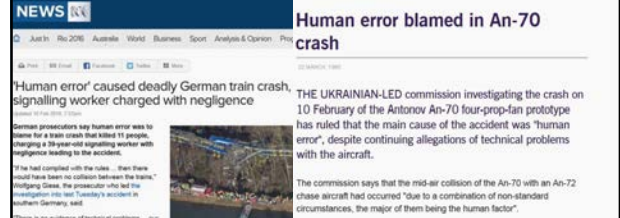
Wm0821 Responsible Management of Risk & Safety  
 Simone Silleme (Safety and Security Science Group)

November 21<sup>st</sup> 2016

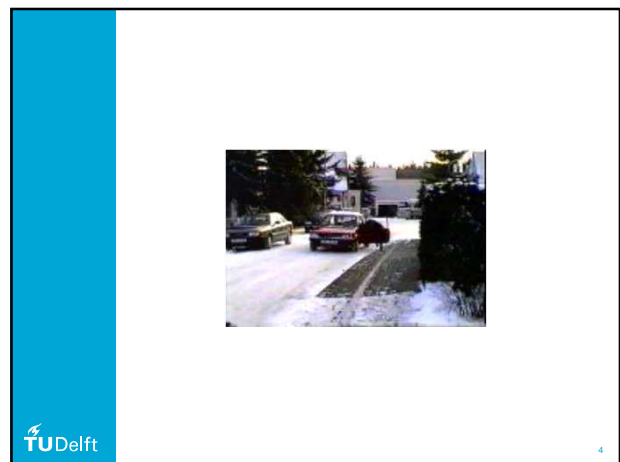
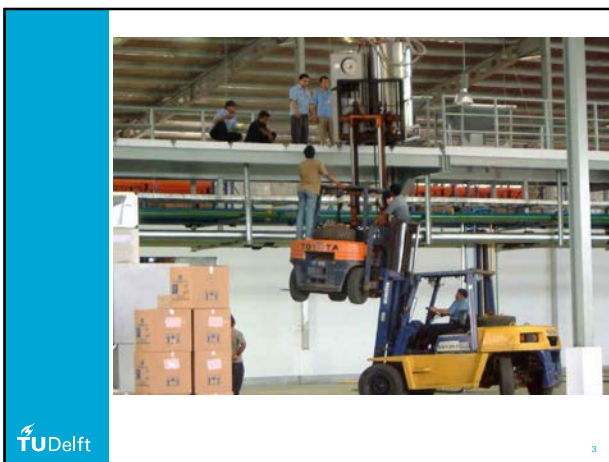
**Alton Towers Smiler ride crash caused by human error, theme park says**

Passengers had to be cut free from wreckage and airlifted to hospital after carriage carrying 50 passengers collided with empty one.




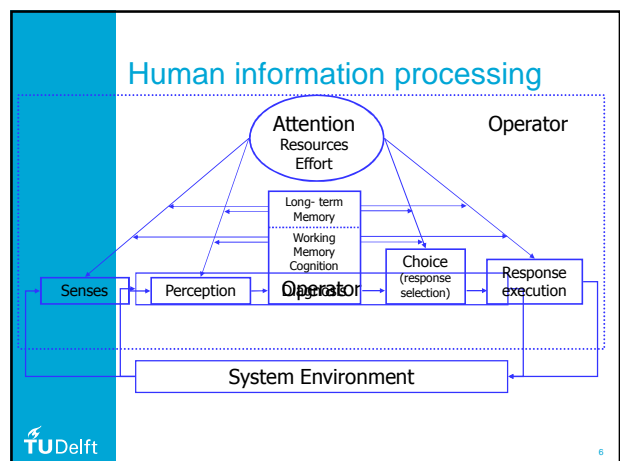
**Human error blamed in An-70 crash**

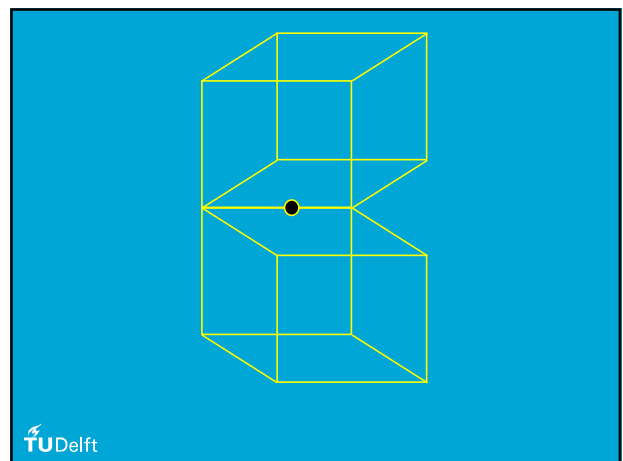
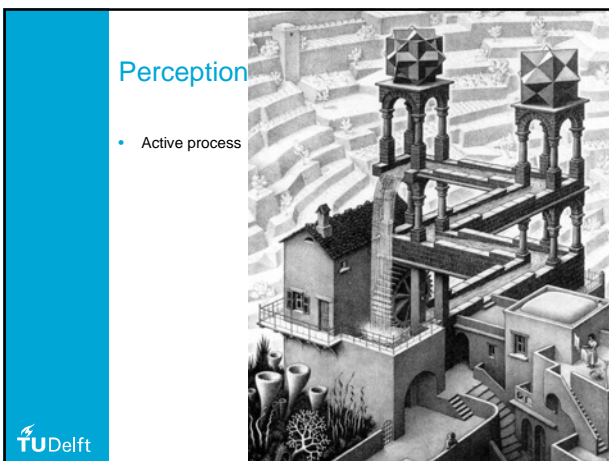
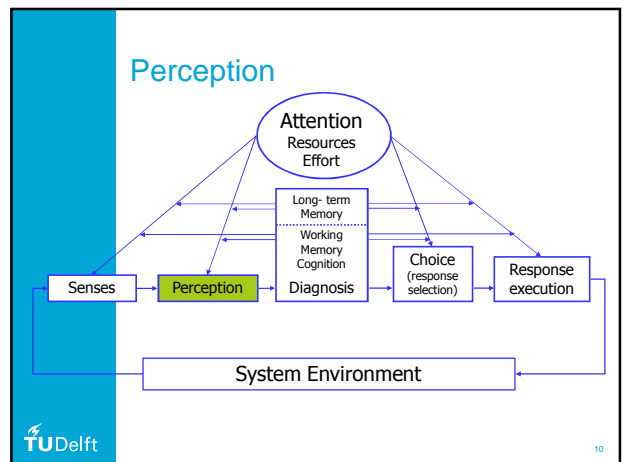
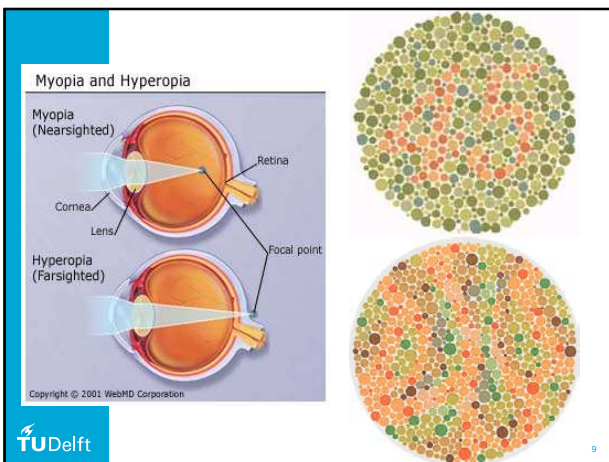
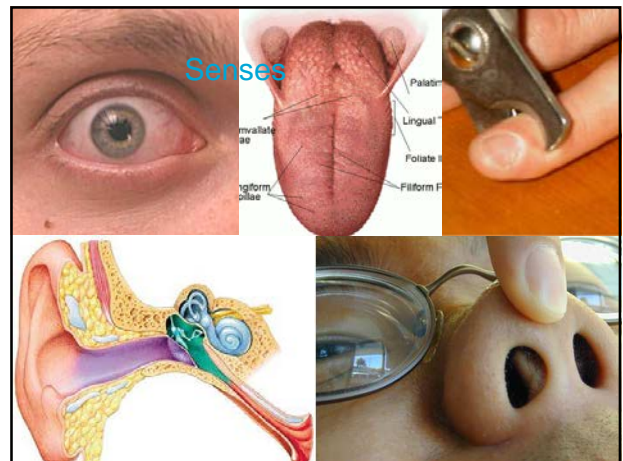
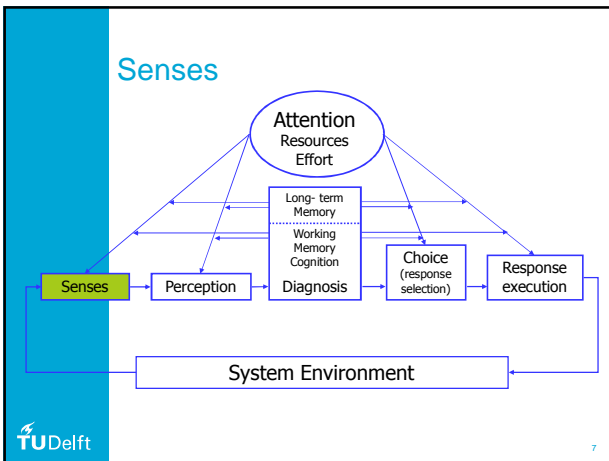
THE UKRAINIAN-LED commission investigating the crash on 10 February of the Antonov An-70 four-prop-fan prototype has ruled that the main cause of the accident was "human error", despite continuing allegations of technical problems with the aircraft.



## Content

- Model of human information processing
- Limitations of human information processing



## Perception

- Context dependent

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## Margaret Thatcher illusion

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- Aiccdonrg to a sudty at the Ueistvniry of Cbdiaarme, it is not iatnmropt in waht order the lrettes of a word are wtiern. The only tnhig that is iatmrpnt is taht the frsit and the lsat lteter are at the rghit lcaitoon. The rest can be mexid, and you wlil stlil be albe to raed it whutoit any polmebrs. The etnxlipaaoon is taht the haumn biran deos not read ipeenedndndt ltteers, but wdors as a wohle.
- vlognes een odenzroek aan de Cmabrigde Uinervtisy, is het niet baelngijk in wleke vlgodore de ltetres van het worod satan. Het einge blenargijke is dat de eretse en de lastate ltteer van het worod op de juiste palats staan. De rset kan geowon door elakar ggoioed wrdoen en je kan het toch nog lzeen zeondr prelobemn. De vrkelraing is dat de mnseleijke hscreenen niet alle lteters afoznedrijjk leezn, maar het worod als een geehel.

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## Understanding

```

    graph TD
        Senses --> Perception
        Perception --> Diagnosis
        Diagnosis --> Choice["Choice (response selection)"]
        Choice --> Response["Response execution"]
        Senses --> Choice
        Perception --> Response
        Diagnosis --> Response
        Choice --> Response
        Attention["Attention Resources Effort"] --> Senses
        Attention --> Perception
        Attention --> Diagnosis
        Attention --> Choice
        Attention --> Response
        LongTerm["Long-term Memory"] --> Perception
        LongTerm --> Diagnosis
        LongTerm --> Choice
        LongTerm --> Response
        WorkingMemory["Working Memory Cognition"] --> Perception
        WorkingMemory --> Diagnosis
        WorkingMemory --> Choice
        WorkingMemory --> Response
        SystemEnvironment["System Environment"] --> Senses
        SystemEnvironment --> Perception
        SystemEnvironment --> Diagnosis
        SystemEnvironment --> Choice
        SystemEnvironment --> Response
    
```

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### How can this be true?

Parts have been moved

So: where does this hole come from?

But exactly the same parts have been used

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### Understanding of a situation...

Depends on the way you look at it as a consequence of:

- Recent tasks
- Experience
- Intentions

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### Deciding

Attention Resources Effort

Long-term Memory  
Working Memory  
Cognition

Senses → Perception → Diagnosis → Choice (response selection) → Response execution

System Environment

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### SRK Taxonomy of Rasmussen (levels of decision making)

- Skills
- Rules
- Knowledge

Rasmussen, J. (1983)  
Skills, rules, knowledge : signals, signs, and symbols : and other distinctions in human performance models  
IEEE Transactions on Systems, Man, and Cybernetics 1983 SMC-13 257-266

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### Skills

- Routine action
- Little conscious effort
- Automatic 'mode of operation'

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## Rules

- Relatively common action
- Start after conscious choice of a rule or procedure
- Information available does not determine the behaviour, but is used in the selection of a rule



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## Knowledge

- New situation
- Necessary to use abstract knowledge
- Choice between alternative plans



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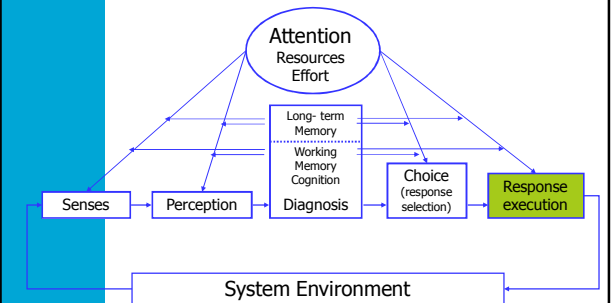
## Conceptual Model



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## Execution



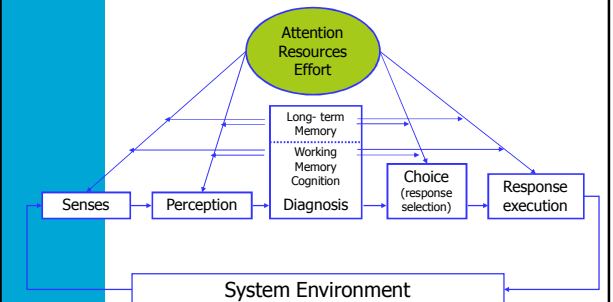
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## Attention

- Paying attention
- Drawing attention



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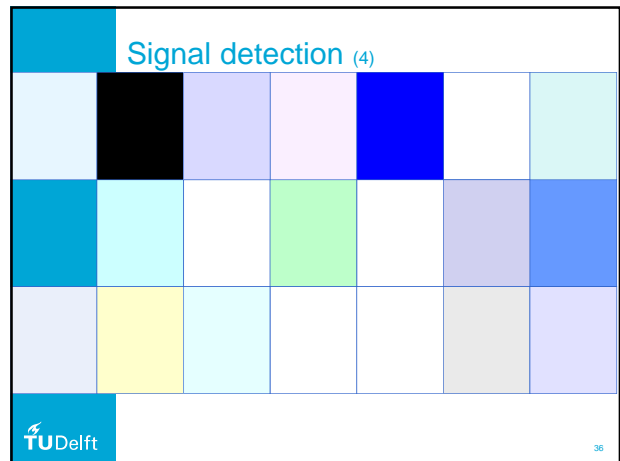
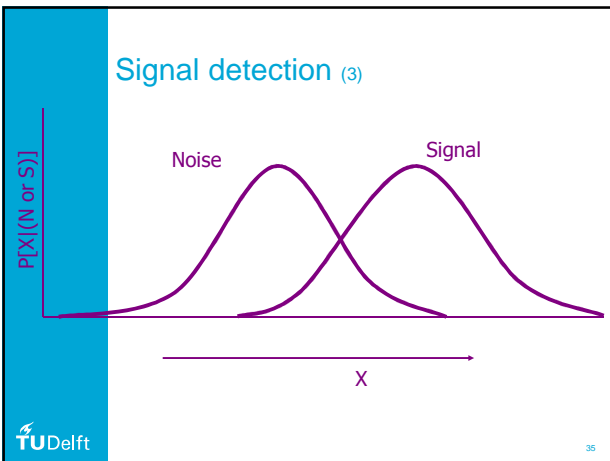
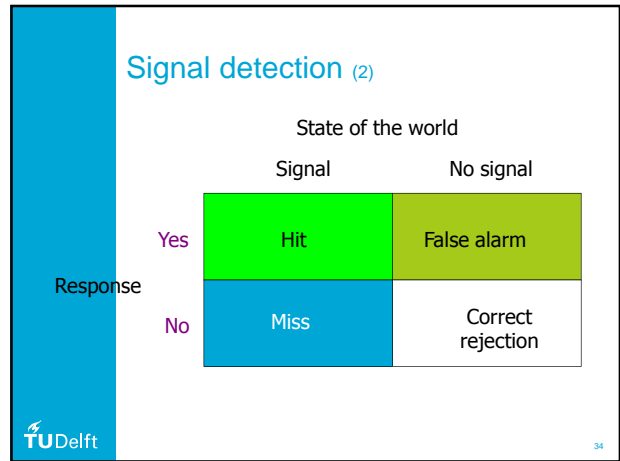
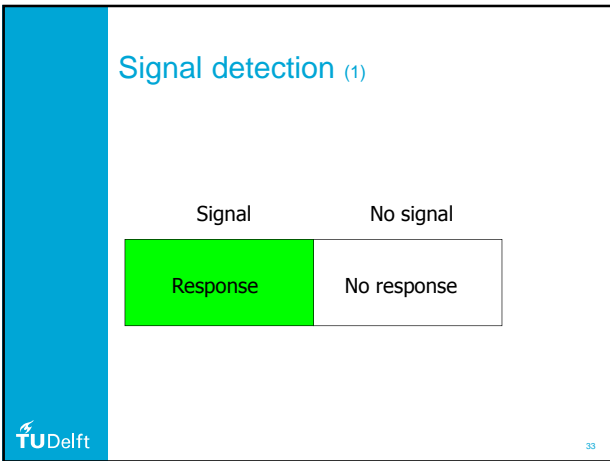
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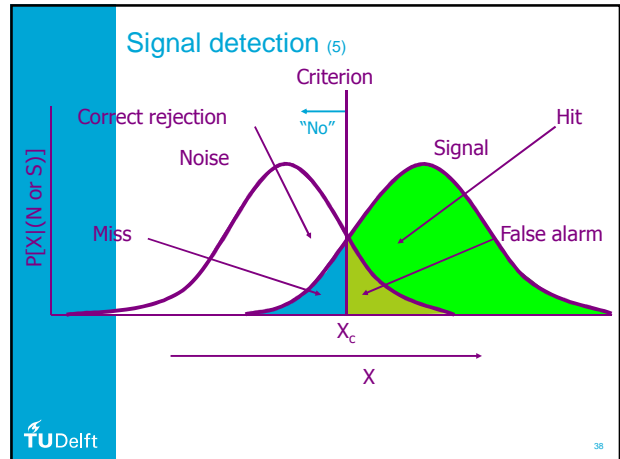
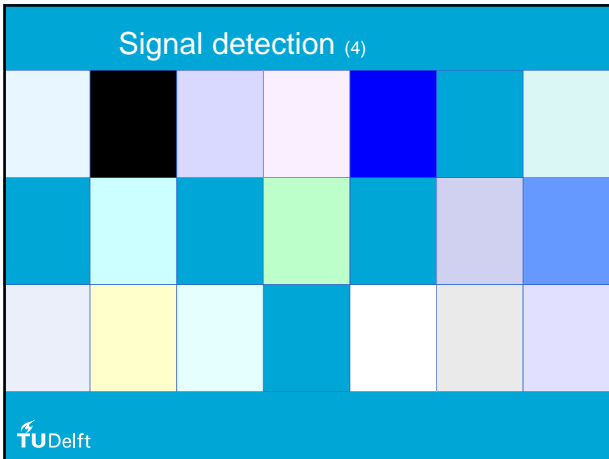


### Limitations of HIP

Senses	Signal detection
Perception	
Understanding	
Choice	
Execution	
Attention	
Memory	

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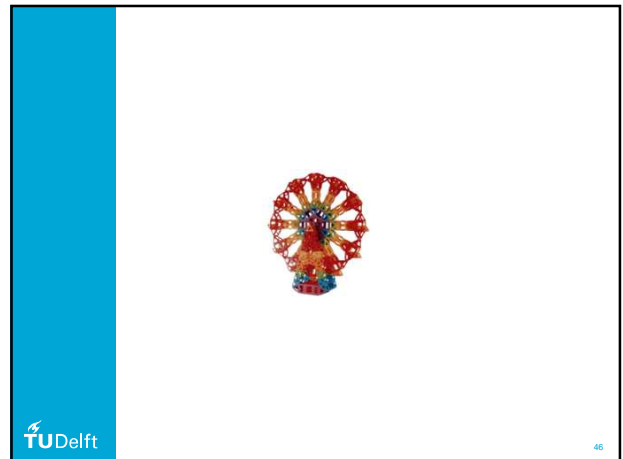
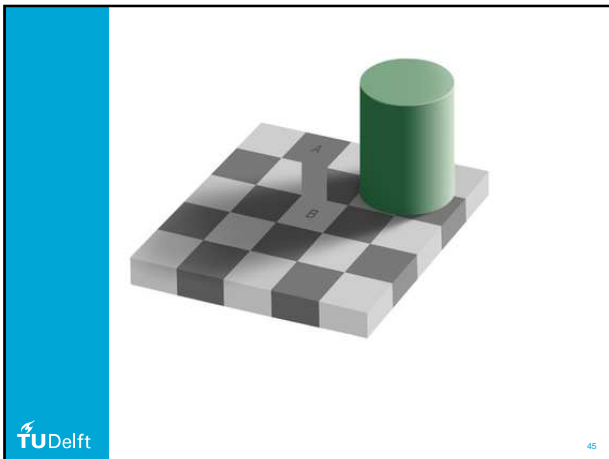
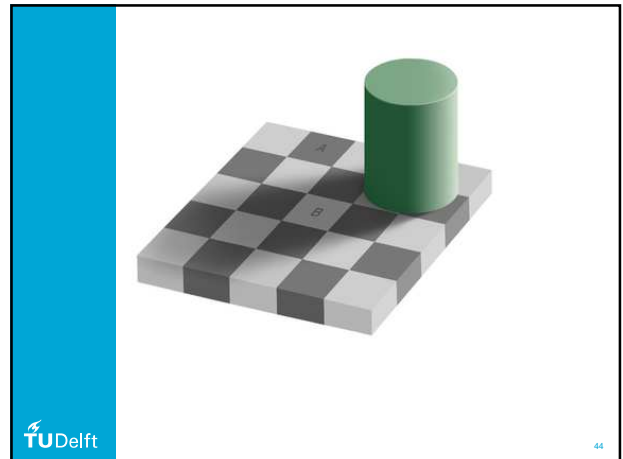
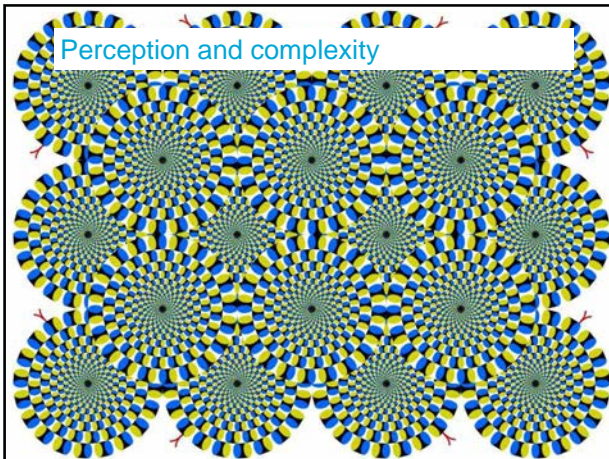




### Limitations of HIP

Senses	Signal detection
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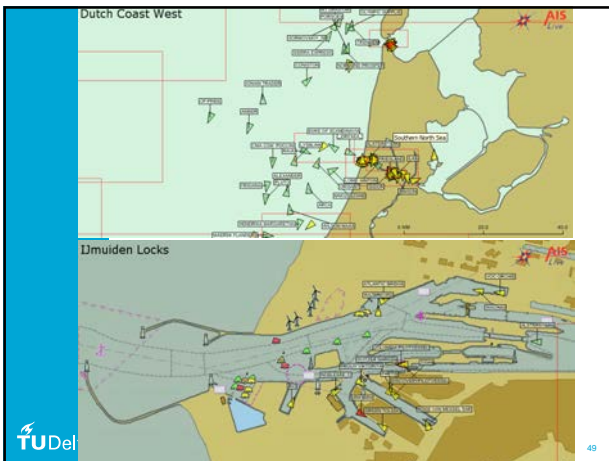
Limitations of HIP

Senses	Signal detection
Perception	Complexity, uncertainty
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Choice	
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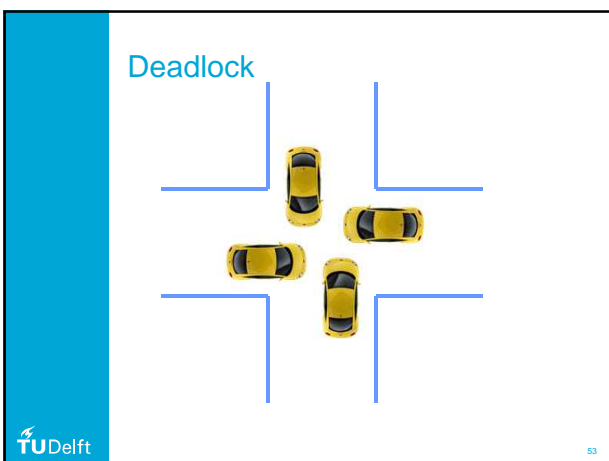
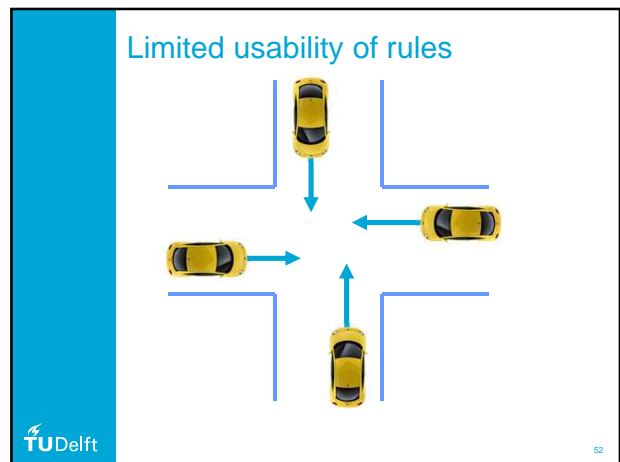
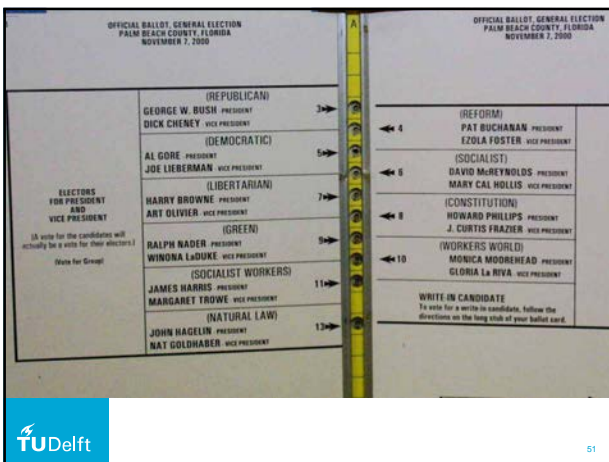




### Limitations of HIP

Senses	Signal detection
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Understanding	Limited or partial information
Choice	Limited usability of rules
Execution	
Attention	
Memory	

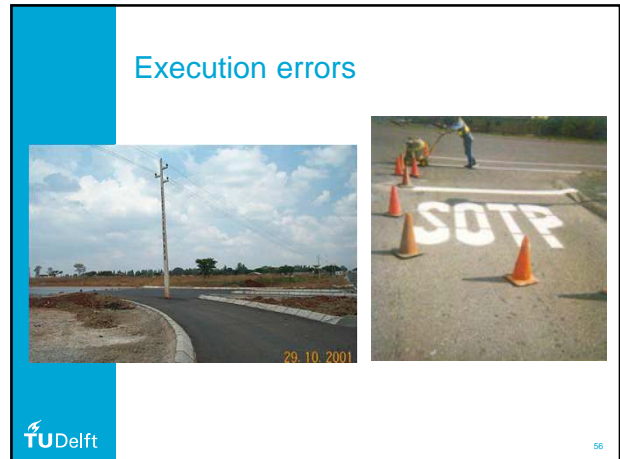
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### Limitations of HIP

Senses	Signal detection
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Execution	Execution errors
Attention	
Memory	

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### Limitations of HIP

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Execution	Execution errors
Attention	Incorrect model or expectations
Memory	

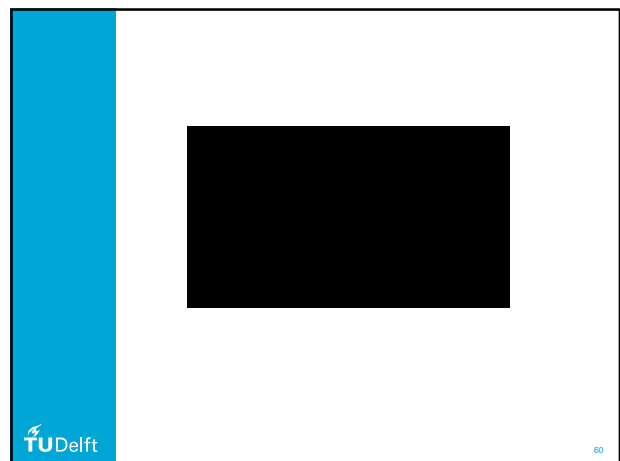
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### Limitations of HIP

Senses	Signal detection
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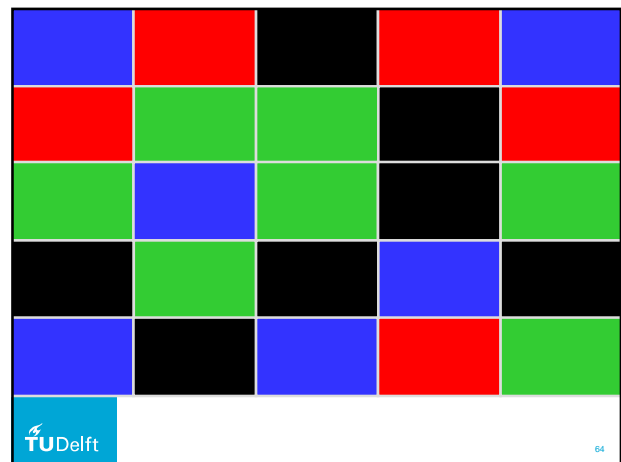
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### Test: Stroop task

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Blauw	Blauw	Rood	Groen	Rood
Rood	Rood	Zwart	Groen	Rood
Rood	Blauw	Blauw	Rood	Groen
Zwart	Rood	Zwart	Zwart	Groen
Rood	Groen	Rood	Zwart	Blauw

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Blauw	Zwart	Blauw	Groen	Zwart
Groen	Rood	Zwart	Groen	Rood
Blauw	Zwart	Blauw	Rood	Rood
Zwart	Rood	Zwart	Blauw	Groen
Rood	Groen	Rood	Zwart	Zwart

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