Proposing a Risk Monitor Model based on Emotions and Feelings:

A Discussion on Attention Operation and Attention Limitations

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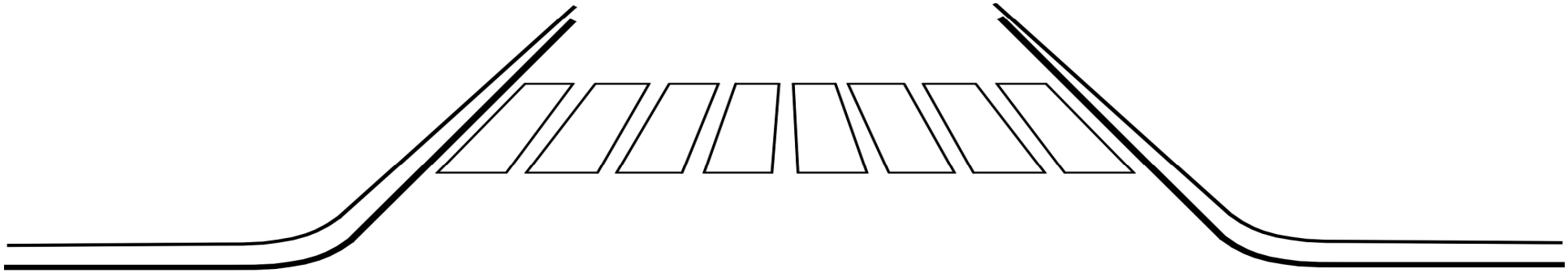
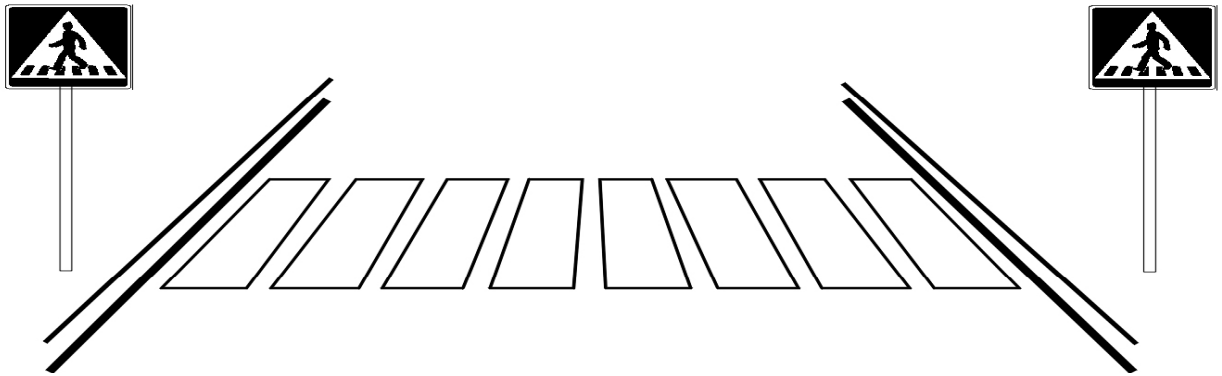
EXPLORING THE LIMITATIONS OF PERCEPTION AND LEARNING

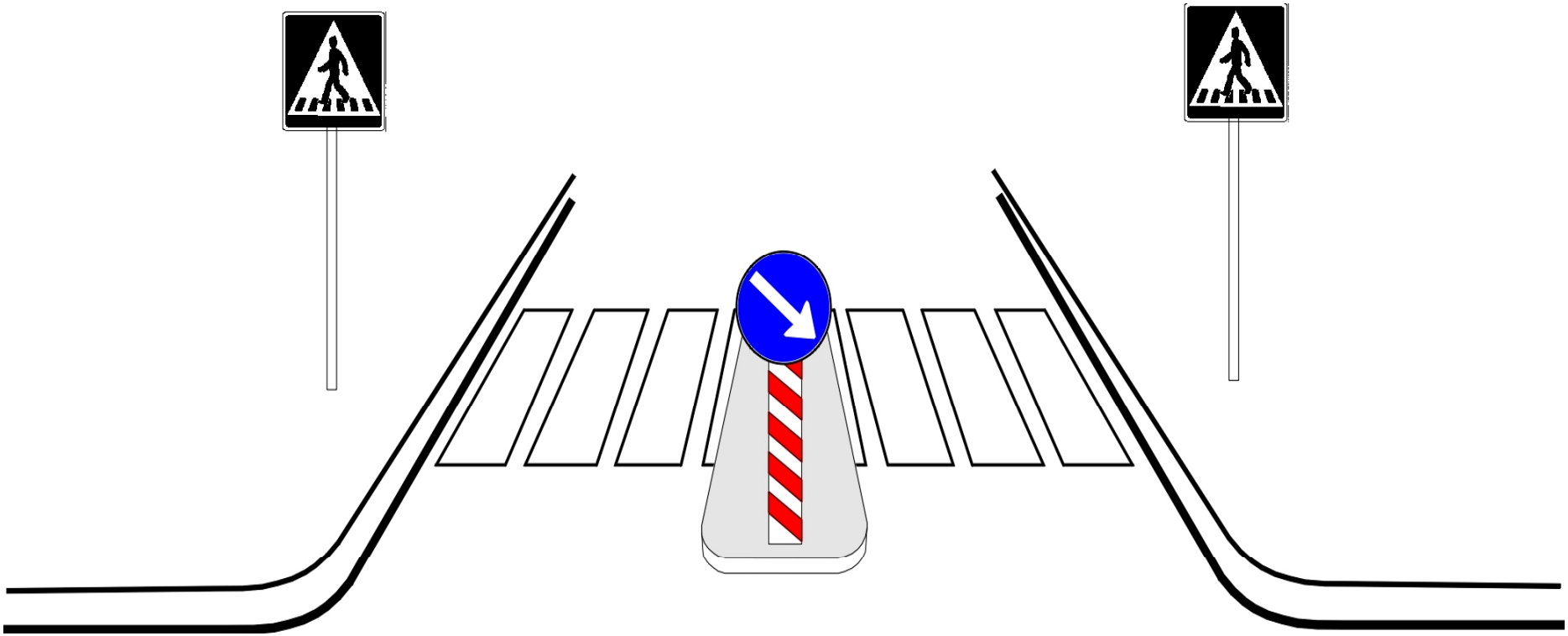
- *Limitations of perception ➔ Limitations in learning schemes?*
- *Why do drivers not perceive what is there ….?*
- *Two accident scenarios:*
- *1) Pedestrians at pedestrian crossings*
- *2) MCs/two-wheelers on a crossing course*
- *Try to explain by a risk monitor model of driver behaviour*

Ordinary marked pedestrian crossing with and without signposts





Marked pedestrian crossing with refuge



Raised pedestrian crossing

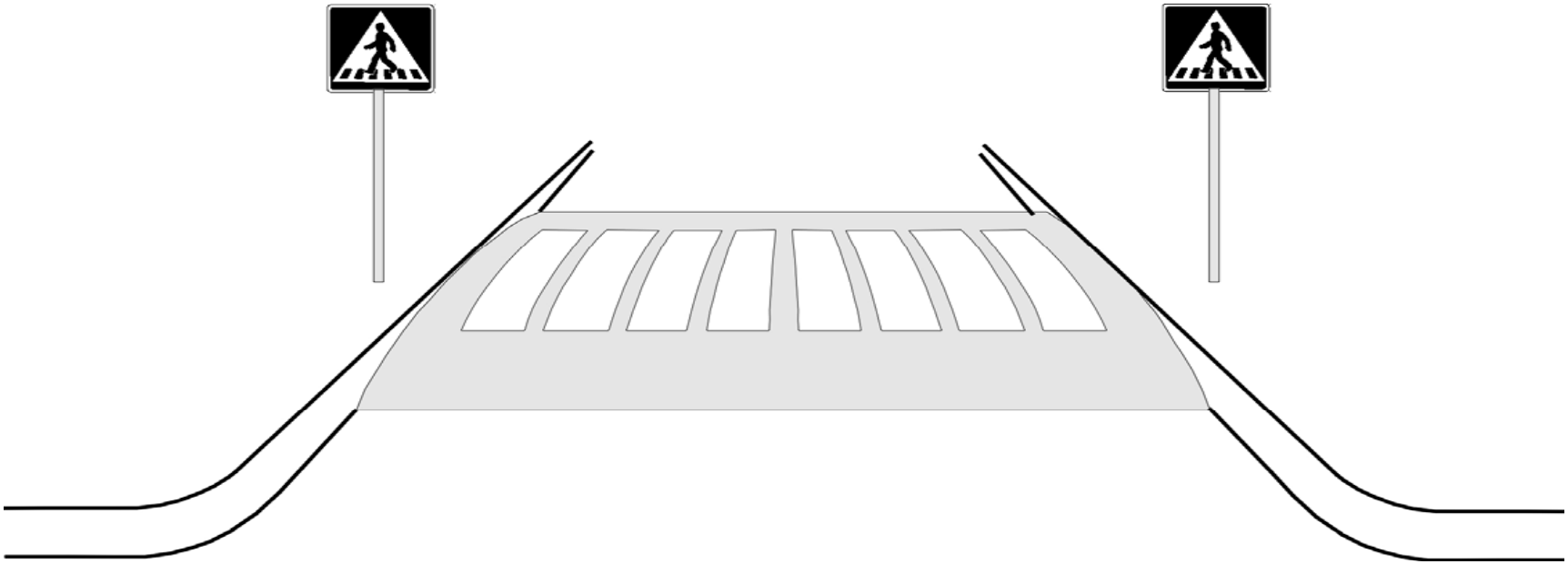


Table 1: Traffic control measures for pedestrians with statistically significant effects on accidents. Percentage change in the number of accidents. (From: Elvik and Vaa, 2004).

	Percentage change in the number of accidents		
Accident severity	Types of accident affected	Best estimate	95% Confidence interval
Ordinary marked pedestrian crossings			
Injury accidents	Pedestrian accidents	+28	(+19; +39)
Injury accidents	Vehicle accidents	+20	(+5; +38)
Injury accidents	All accidents	+26	(+18; +35)
Refuges on pedestrian crossings			
Injury accidents	Pedestrian accidents	-18	(-30; -3)
Injury accidents	Vehicle accidents	-9	(-20; +3)
Injury accidents	All accidents	-13	(-21; -3)
Raised pedestrian crossings			
Injury accidents	Pedestrian accidents	-49	(-75; +3)
Injury accidents	Vehicle accidents	-33	(-58; +6)
Injury accidents	All accidents	-39	(-58; -10)

Norwegian study of 36 accidents with pedestrians (Statens vegvesen, 2001)

- In 24 of 36 accidents the cause was attributed to the drivers
- Driving speeds were too high, and/or ***"too low awareness about risks although the circumstances called for something different"***
- In 28 of 36 accidents drivers did not see the pedestrians ***"before it was too late"***
- One of the most pronounced explanation was:
- 1)Drivers are more ***"…directed towards other road traffic than to spot pedestrians"***
- ***"…..did not see the pedestrians before it was too late"***
- ***"….more directed towards other road traffic than to spot pedestrians"***
- ***WHY ?***

Chain of reasoning:

- ***Empirical base (I):*** Driver inattention is a prevalent characteristic which contributes to accidents at pedestrian crossings
- ***Empirical base (II):*** Pedestrian crossings with refuge, and raised pedestrian crossings, reduce the number of accidents with pedestrians, while ordinary marked pedestrian crossings increases the number of accidents with pedestrians
- ***Assumption (axiom?):*** Pedestrian behaviour does not differ significantly between crossing types, it remains the same across all types of pedestrian crossings listed in table 1 above
- ***Inference:*** Driver attention must operate differently in these three types of crossings (reduced figure 1 and enhanced in figures 2 and 3)

- ***Problem statement:*** Why is attention reduced in situation **"ordinary pedestrian crossing"** and enhanced in situations "crossing with refuge"/**"raised pedestrian crossing"?**

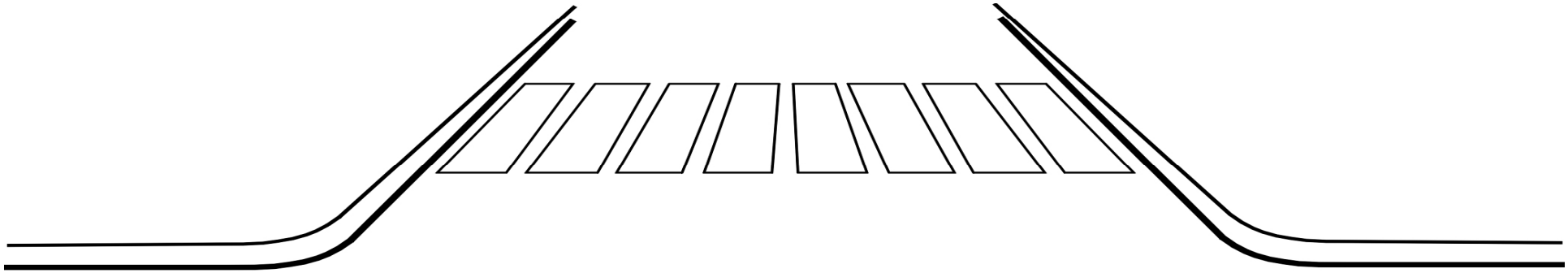
Table 3: Frequency of pedestrians observed in ordinary marked pedestrian crossings in

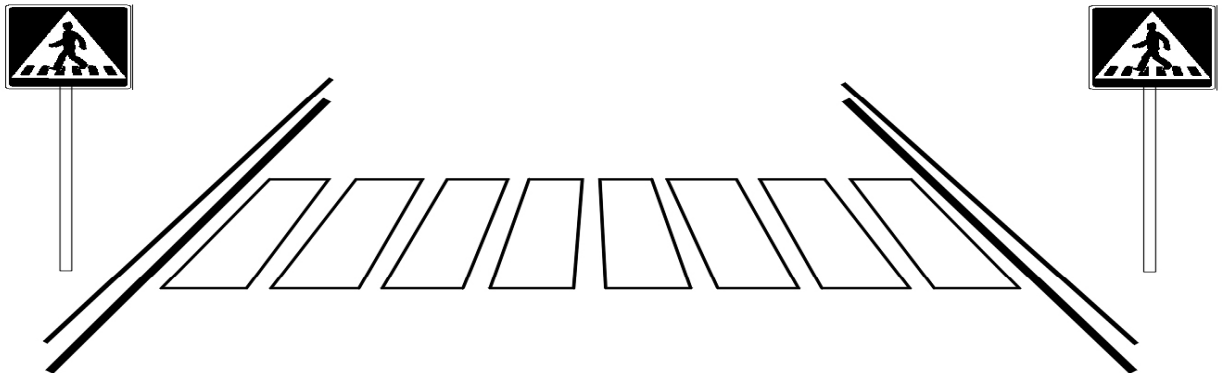
an ad hoc-sample of Norwegian cities, suburb and villages and

one week-end roundtrip in France. Number of trips, observations, and ratio between empty and "filled" pedestrian crossings (from [5])

Location	***Category***	***Number of trips***	***# of pedestrians : # of crossings***	***Pedestrians : crossings (ratio)***
Oslo	City	12	13 : 198	**1 : 15**
Jevnaker/Hønefoss	Village/City	28	28 : 703	**1 : 25**
Sokna	Village	105	9 : 314	**1 : 35**
Bærum	suburb	66	6: 355	**1 : 59**
Kongsberg	City	14	1 : 67	**1 : 67**
Rjukan	City	22	2 : 526	**1 : 263**
Round-trip Paris-Nancy-Colmar-Dijon-Paris	Several villages/cities	1	0 : 116	**0 : 116**

Ordinary marked pedestrian crossing with/without signposts





Chain of reasoning (cont….)

- ***Assertion (1):*** What is actually learned – and reinforced – is that an ordinary pedestrian crossing normally is ***empty.***

- **Assertion (2):** Such a crossing ***does not provide any specific stimuli*** that makes it different from the road environment before and after the crossing has been passed

- ***Assertion (3):*** The ***experience is automated*** and does not provide any stimuli that are being consciously processed

- ***Assertion (4):*** As the number of accidents is reduced in raised pedestrian crossings, and crossings with refuge, and assuming pedestrian behaviour does not vary significantly across different pedestrian crossing types, ***driver attention must operate significantly different*** with the two former types of crossings than with an ordinary marked pedestrian crossing.

Chain of reasoning (cont….)

- ***Assertion (5):*** Unlike an ordinary marked pedestrian crossing, where there normally is no feedback of potentially damaging stimuli, ***a raised pedestrian crossing represents potentials of damaging the car*** if the speed is too high.

- ***Assertion (6):*** Likewise with a ***crossing with refuge***: the lane width could be so narrow that the ***driver must consider his/her distance to the curbs*** on both sides of the car. Such damaging potentials do not exist in the situation of an ordinary marked pedestrian crossing, there is no bump in the car, and drivers do not need any appraisals of his/her lateral position as lane widths are ample.

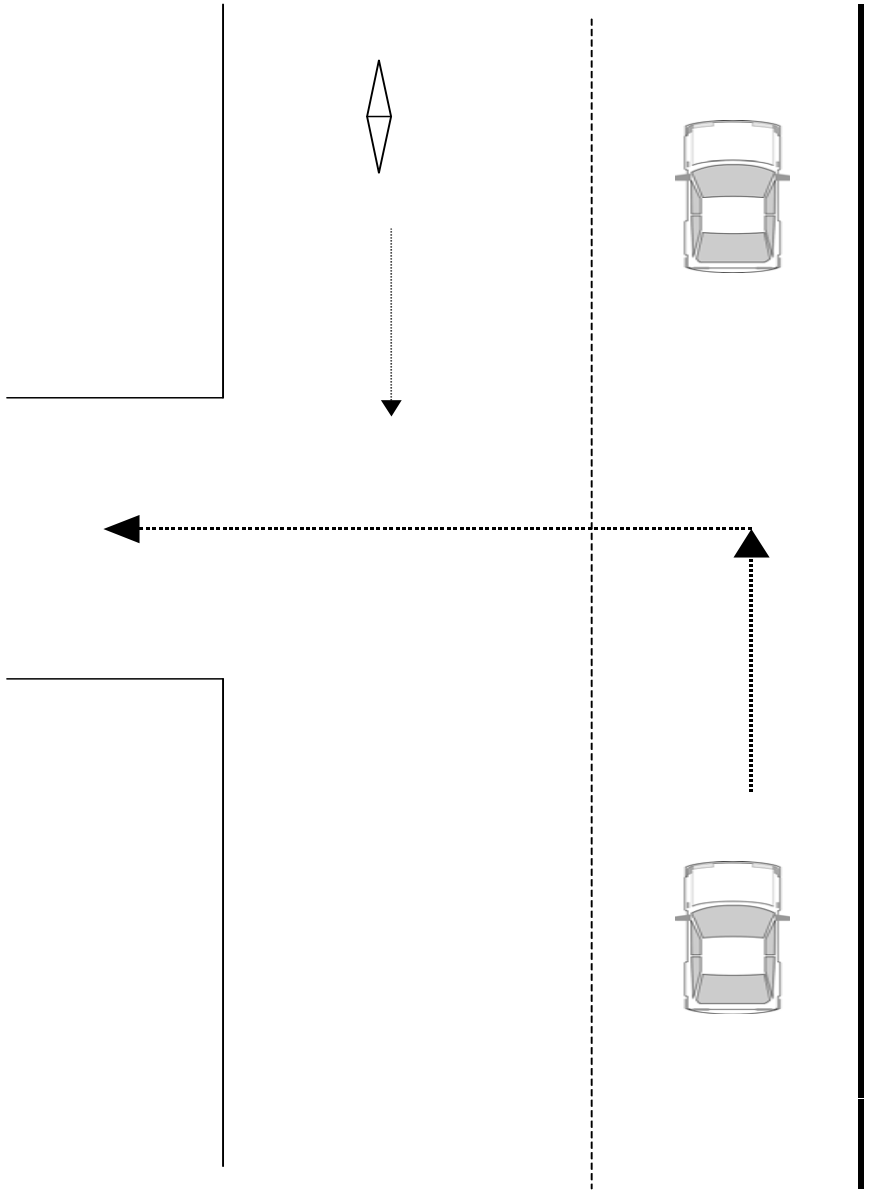
- ***Assertion (7):*** These appraisals of car damaging potentials, and/or in combination with reduced driving speeds, is what ***make perception and attention work differently*** from the situation of an ordinary marked pedestrian crossing, and hence, reduce the number of accidents. That is possibly why accidents are reduced by these two solutions.

Questions about reinforcement and the building of schemes:

- ***Will single experiences make changes in learning ?***
- ***Will single experiences become extinct because it is followed by (numerous) experiences of empty crossings ?***
- ***Do drivers need a "narrow escape" in order to learn ? Will one narrow escape be generalized in time and space?***
- ***What exactly does represent a "danger" to a driver in contexts where pedestrian crossings appear?***
- ***Are drivers more concerned about damage to their cars than to people, simply because the probability is much higher?***

Looking for dangers ?

Motorcyclists are overrepresented



More questions…..

- Is there “a rank order of threatening events” ?

- Threats to being hit by another driver?
- Threats to damaging the car?
- The possibility of injuring a pedestrian?

- Do drivers rank threats and dangers in this rank order ?
- (unconsciously, represented by automated schemes governing behaviour)

- Damasio (1994): Modelling information processing and decision-making:

Antonio S. Damasio: ”Descartes’ Error: Emotion, Reason and the Human Brain”(1994):

- *Axiom:* Man’s deepest motive: *Survival*

- *Deduction:* We must have an organ, a

  risk monitor for detecting dangers

  that threaten survival

  ⇨ The body *is* the risk monitor

  Emotions and feelings are the tools

Damasio's (unorthodox) definision

- Emotions *(unconscious processes)*

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- Feelings *(conscious processes)*

More on emotions and feelings (Damasio 1994)

- ***Primary emotions:*** Emotions that are innate and unconscious – predispositions for behaviour
- ***Secondary emotions:*** *Emotions that are learnt an*d based on individual experiences – i.e. the schemes, predominantly unconscious.
- ***Feelings:*** The process of “feeling an emotion”, the process of “making an emotion conscious”, to feel and transform changes in body states into conscious experiences.

Damasio on primary emotions:

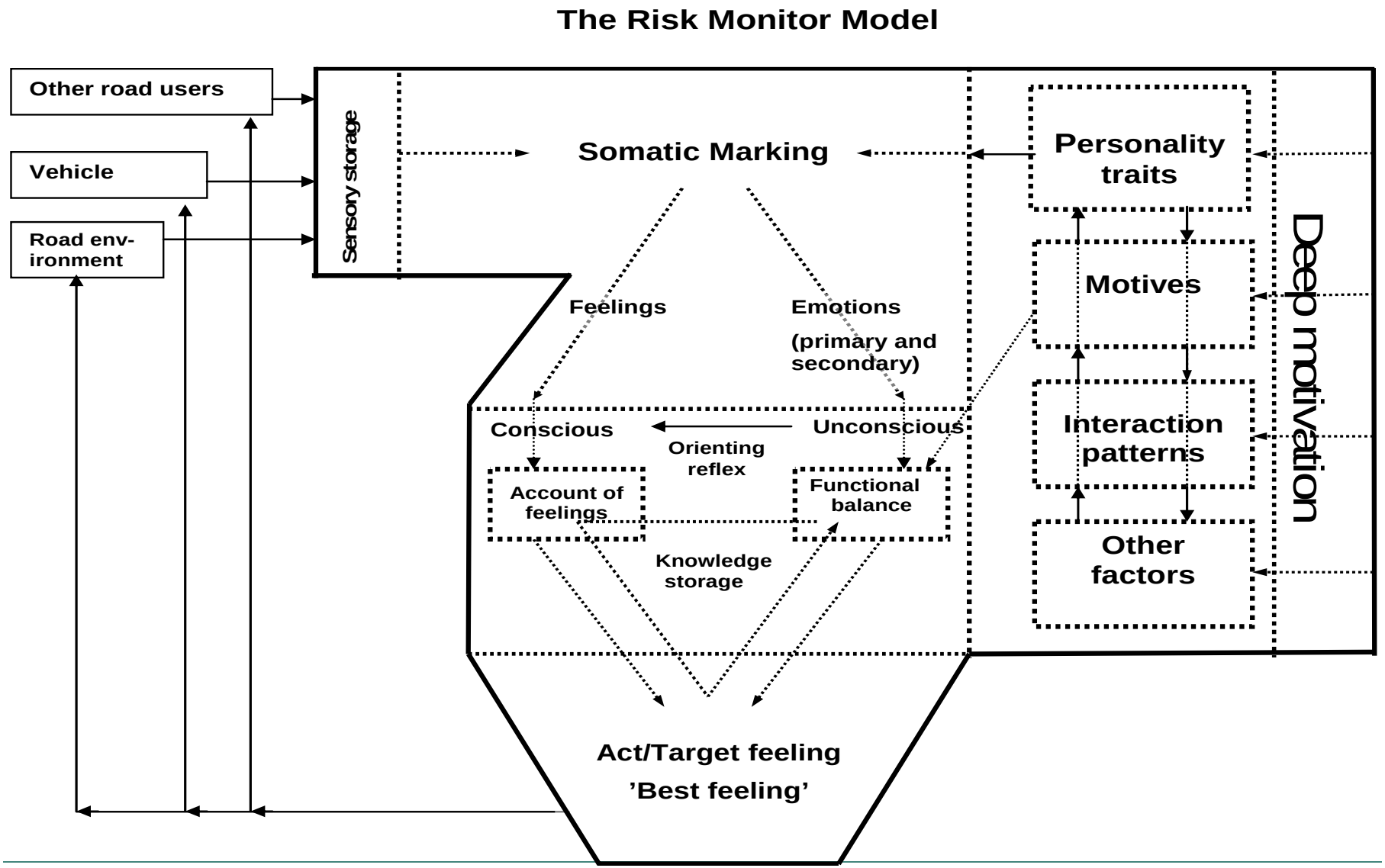
- ***"…. We are wired to respond with an emotion (and a somatic marking), …, when certain features of stimuli … are perceived, alone or in combination". Features as:***

- ***Size (as in large animals)***
- ***Large span (as in flying eagles)***
- ***Type of motion (as in reptiles)***
- ***Certain sounds (such as growling)***

- ***Such features would be processed by the amygdala, which triggers a body state characteristic of the emotion "fear" which again initiates appropriate decision-making***

- ***Assertion (axiom?): The configuration of a moving car is more potent in provoking "fear" than a pedestrian or two-wheeler***

The Risk Monitor Model (RMM)



Proposed countermeasures (predictions of RMM):

- ***Schemes/stimuli of pedestrians and two-wheelers are "too weak"*** to elicit appropriate driver behaviour

- Scenario (1): In the case of an ordinary marked pedestrian crossing: ***Blinking, amber lights*** when pedestrians are about to enter the crossing in a configuration that is comprehensive from left to right roadside/pavement (the alternative would be removal of this type of pedestrian crossing, or use solutions as depicted in figures 2 and 3)

- Accident scenario (2): In the case of an MC a ***continuous use of high-beam running lights*** should be mandatory as low-beam or triangular light configurations are considered to be too weak in providing sufficient strength of stimuli.


Thank you for
listening….

Is it safe to drive in traffic ?
(The "success story" of risk monitoring)

- *From the society's perspective: No !*
- *Individually speaking: Yes !*
- *Risk of personal injury: Approx 0,36 per mill km*
- *≈1 injury/fatality per 2.800.000 km*
- *Suppose: Driver career from 18–83 yoa = 65 yrs - 14.000 km/y*
- *One driver "on the road": 65 yrs x 14.000 km = 910.000 km*
- *2.800.000 km : 910.000 km: ≈3 drivers*
- *1 personal injury per 200 years (80 – 90% minor injury)*
- ***Conclusion:* The average driver is extremely skilled in handling risks**
- ***Hypothesis:** A given ITS must prove that it performs better than the driver to achieve reliance and compliance, otherwise a given ITS would simply not be accepted by the driver*
- *Including property-damage-only accidents: One accident every 10th year…*