



Tell me how you feel: Driver perception of risk on the road

Presented by Dr Neale Kinnear
Principal Psychologist

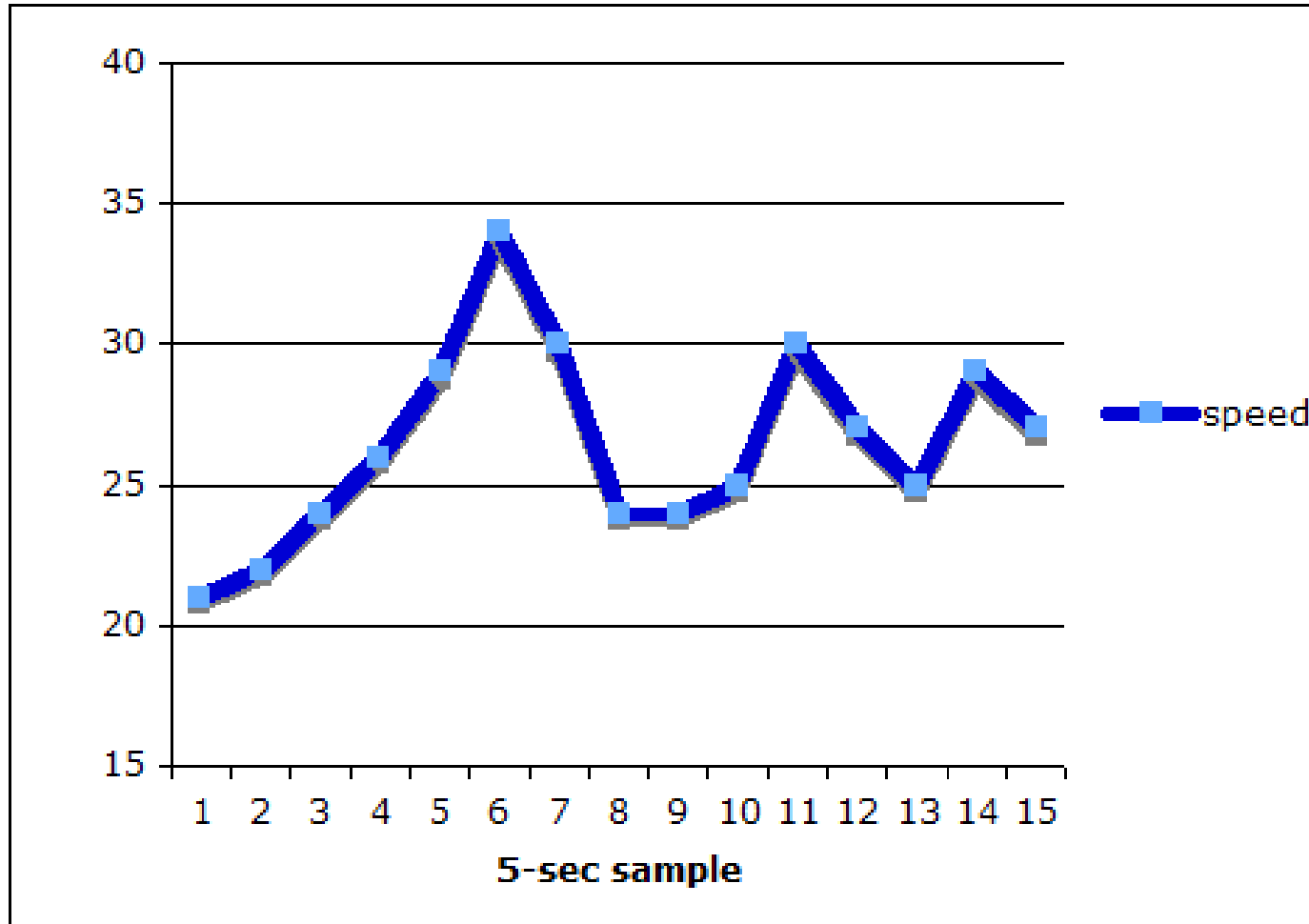
SoRSA Annual Conference 2013





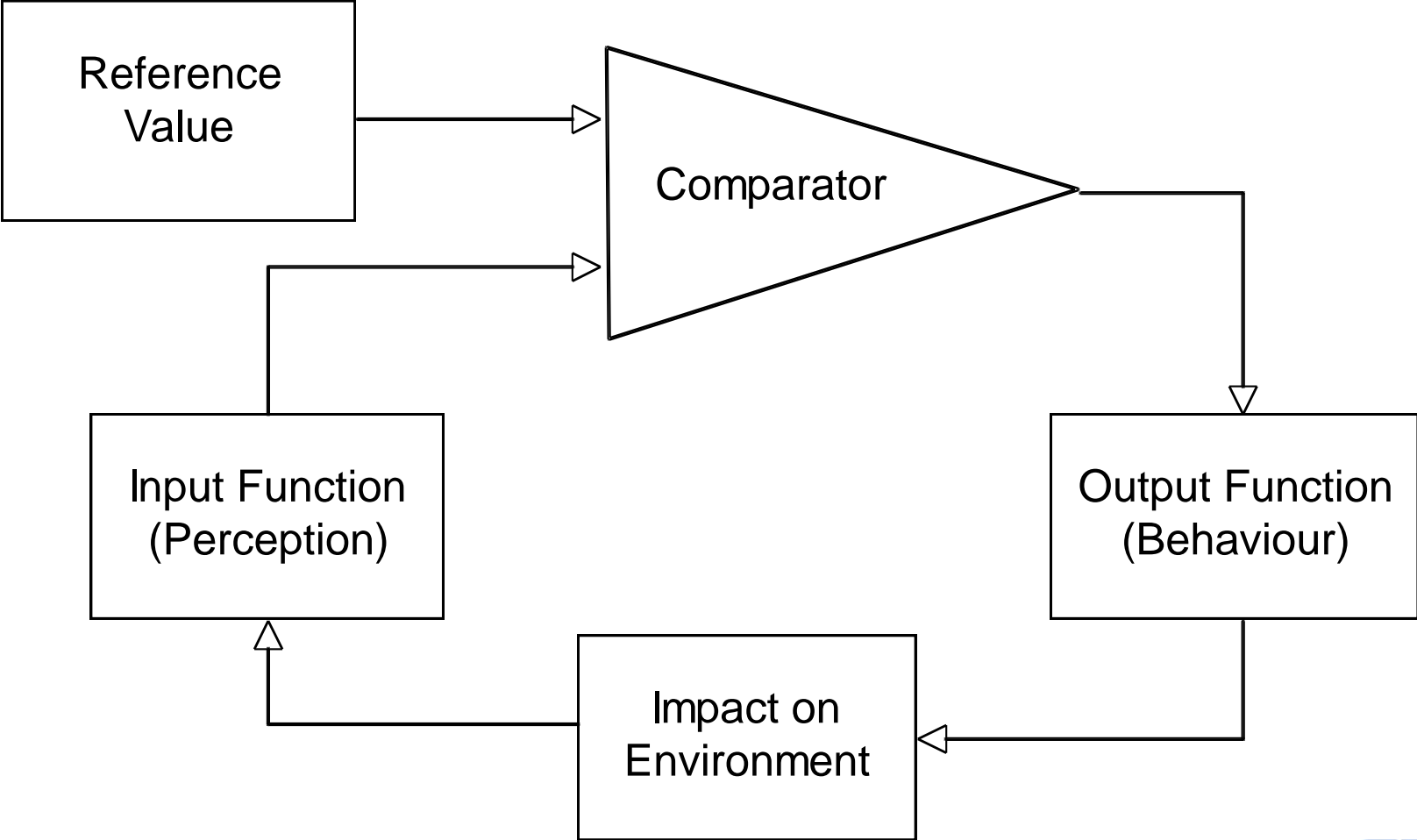
Speed choice

Conscious or unconscious?



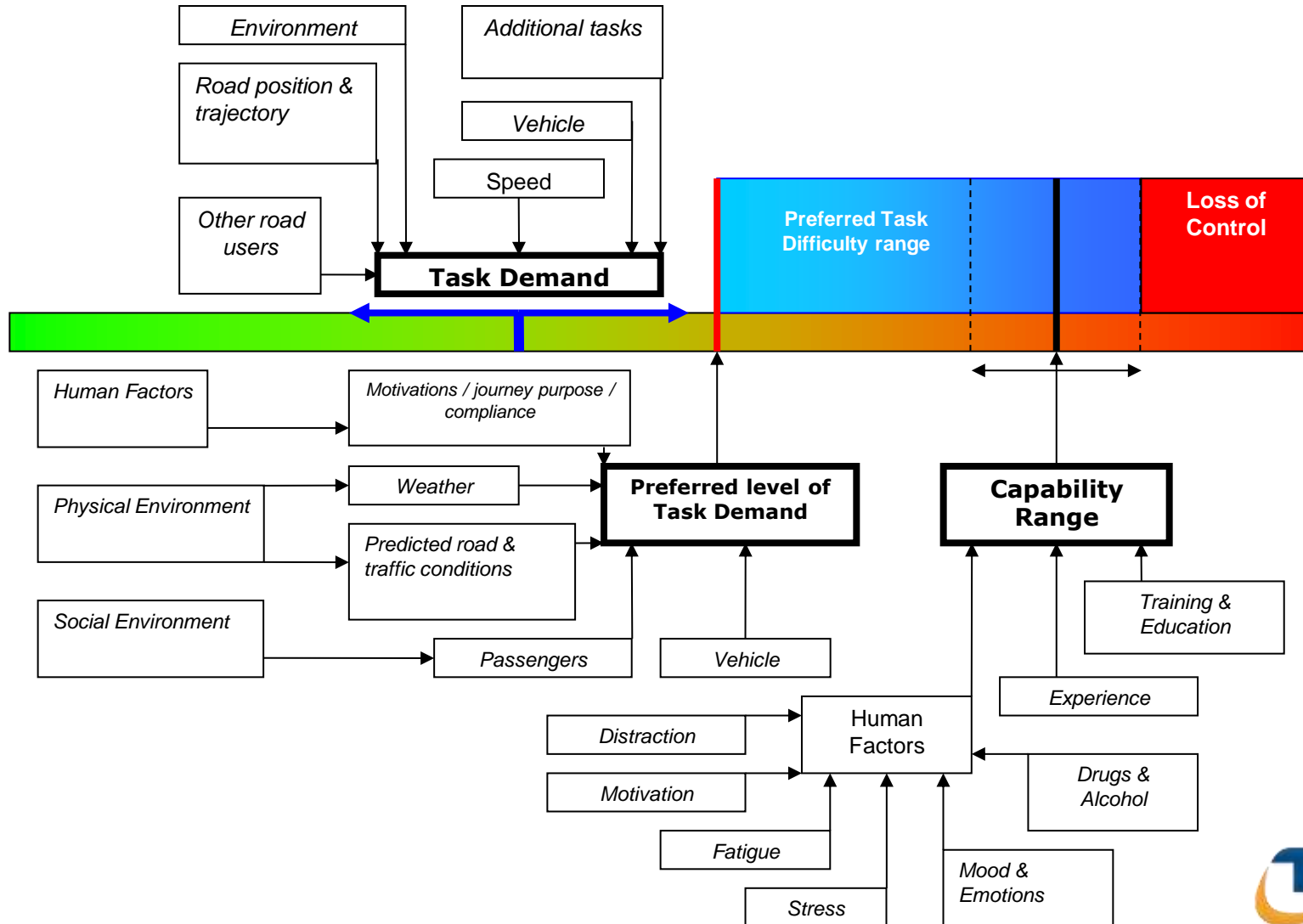
Control Theory

Negative feedback loop



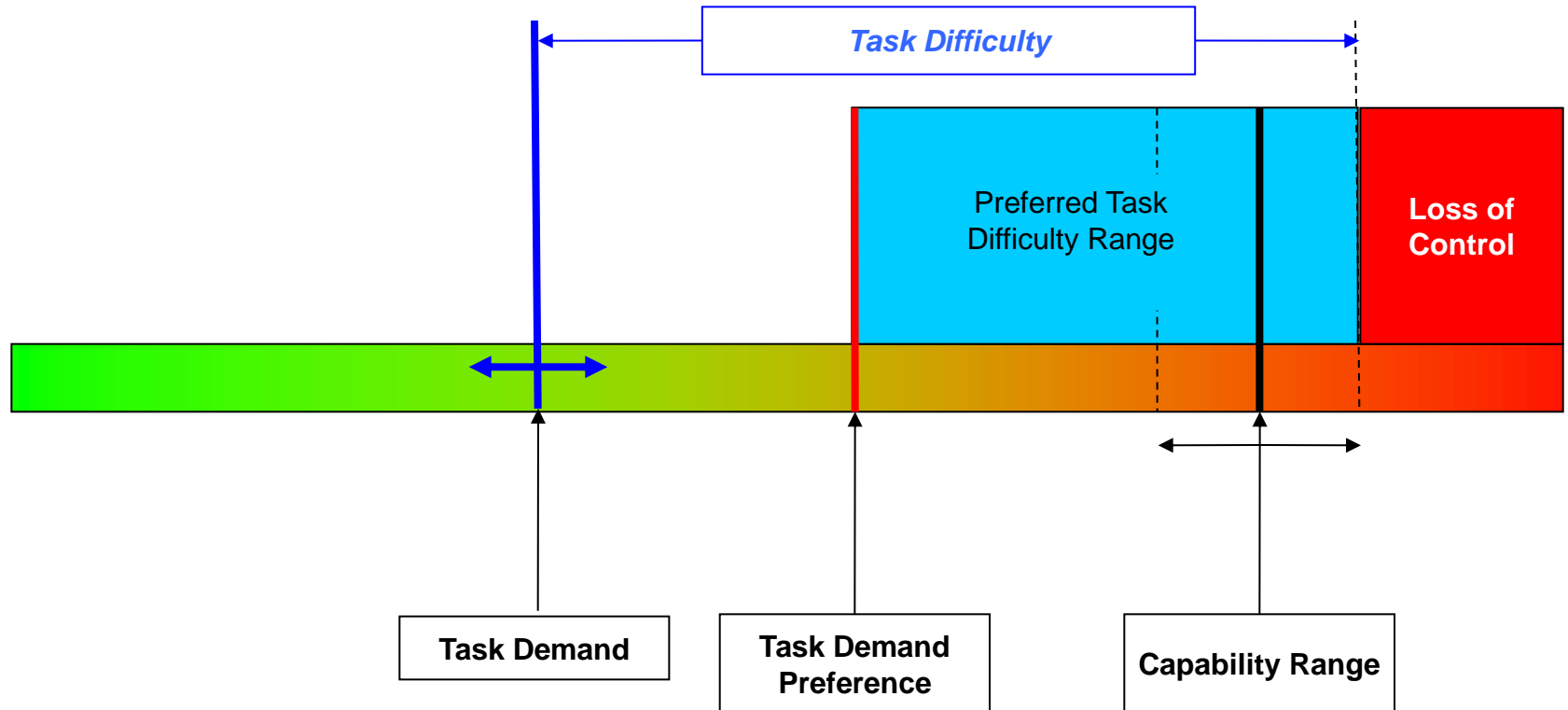
Driver Behaviour Theory

Illustration from Kinnear (2009)



Task Capability Interface Model (Fuller, 2005)

Illustration (Kinnear, 2009)



Determining drivers' ratings of risk

Fuller et al. (2008); Kinnear et al. (2008)

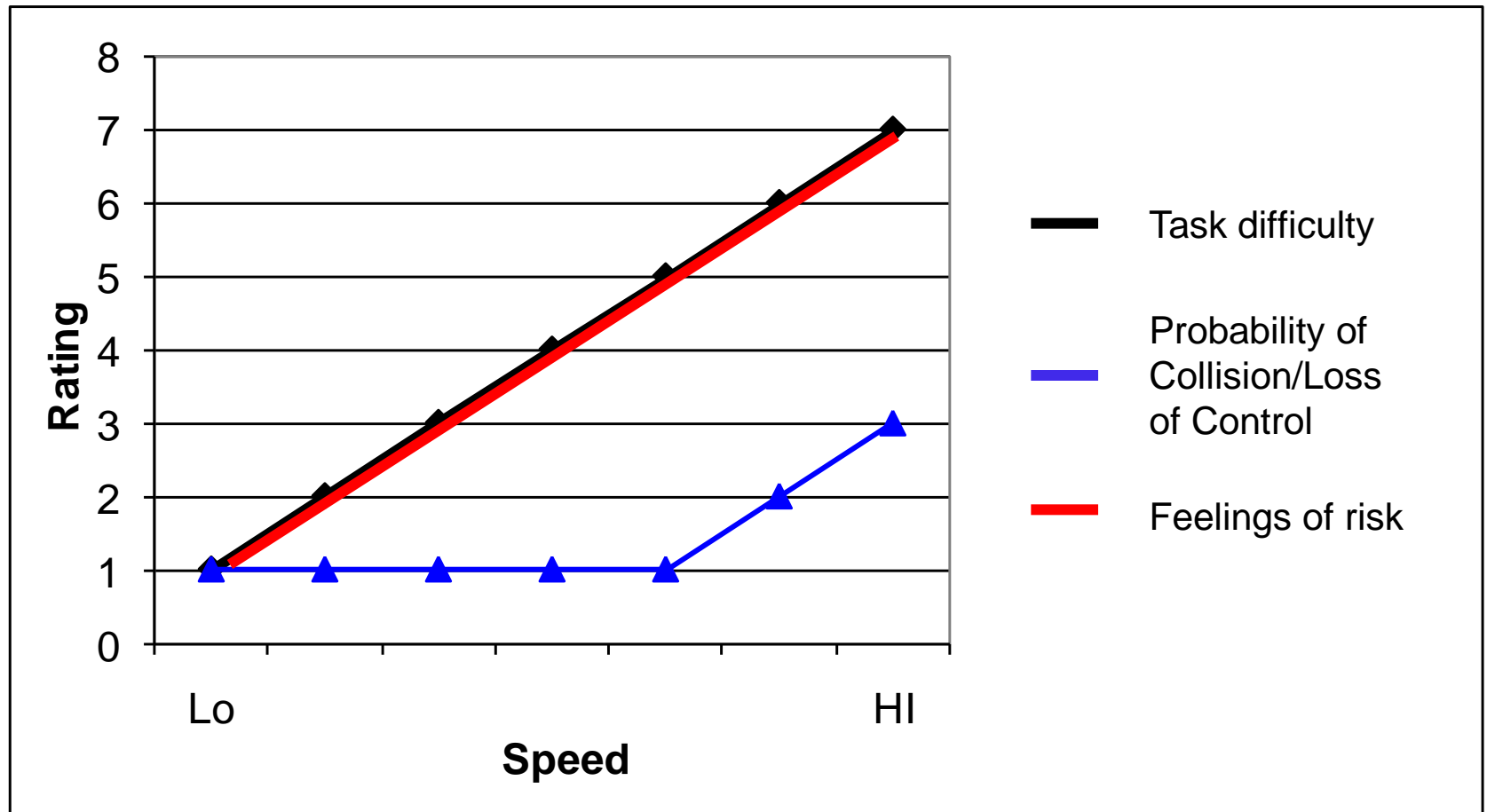
- Participants rated film clips from drivers perspective on a residential road, country road and dual carriageway

- Film clips had been digitally altered and shown at different speeds that were unknown to the participant

- Drivers rated the clips for:
 - Task Difficulty;
 - Feeling of Risk
 - Probability of Collision/Loss of Control

Illustration of results

Fuller et al. (2008)



Ratings of Task Difficulty & Feelings of Risk were correlated to the order of 0.97

Further studies

Kinnear et al. (2008); Lewis-Evans & Rothengatter (2009);
Lang (2011)

- Further study has found that other measures correlate strongly with Task Difficulty and Feelings of Risk:
 - Effort
 - Danger
- Maybe the important point is that they are all measuring conscious appraisal of the demand characteristics of the driving task and indicate that both a form of difficulty (or effort or mental workload) and feelings of risk (or safety or danger) influence appraisal.

What drivers tell us

Focus group quotes from speeding study

- *"I think your body knows you're outside your comfort zone. It just registers something and you say 'back again' instantly, to whatever speed you're comfortable"*
- *"And again it was on the motorway, nobody else about, did it [high speed] for a couple of minutes, stopped whenever there was anything looking like it was getting too close. Just a bit too much sensory input for me, and a little bit too quick, even though feels like an empty road, it doesn't feel comfy"*

Defining Risk

- **Objective Risk**

“relating to external facts, as opposed to internal thoughts or feelings”

The ratio between some measure of unwanted consequences versus some measure of exposure to the situations under which the unwanted consequences are possible (Brown & Groeger, 1988)

- **Subjective Risk**

“based on personal opinion, thoughts, feelings, etc”

2 forms (Summala, 2007; Vaa, 2007; Fuller 2008):

1. Subjective Risk Estimate - a driver's cognitive judgement of the objective probability of being crash involved
2. Feeling of Risk - the sensation and emotional appraisal of risk or potential risk elicited by circumstances in a driver's environment

Modern Theories of Risk Appraisal

Slovic et al (2004)

Modern theories in cognitive psychology and neuroscience indicate that there are two fundamental ways in which human beings comprehend risk:

Analytic system	<ul style="list-style-type: none">▪ Uses algorithms and normative rules▪ Formal logic, and risk assessment	<ul style="list-style-type: none">▪ Relatively slow▪ Effortful▪ Requires conscious control
Experiential system	<ul style="list-style-type: none">▪ Intuitive▪ Fast▪ Mostly automatic▪ Not very accessible to conscious awareness	<ul style="list-style-type: none">▪ Developed through evolution▪ The most natural and most common way for humans to respond to risk▪ Relies on images and associations, linked by experience to emotions (a feeling that something is good or bad). Represents risk as a feeling that tells us whether it is safe to walk down a dark street [or continue driving at a certain speed]

Emotion, Feelings and Decision Making: A Hot Topic

Peters et al. (2006)

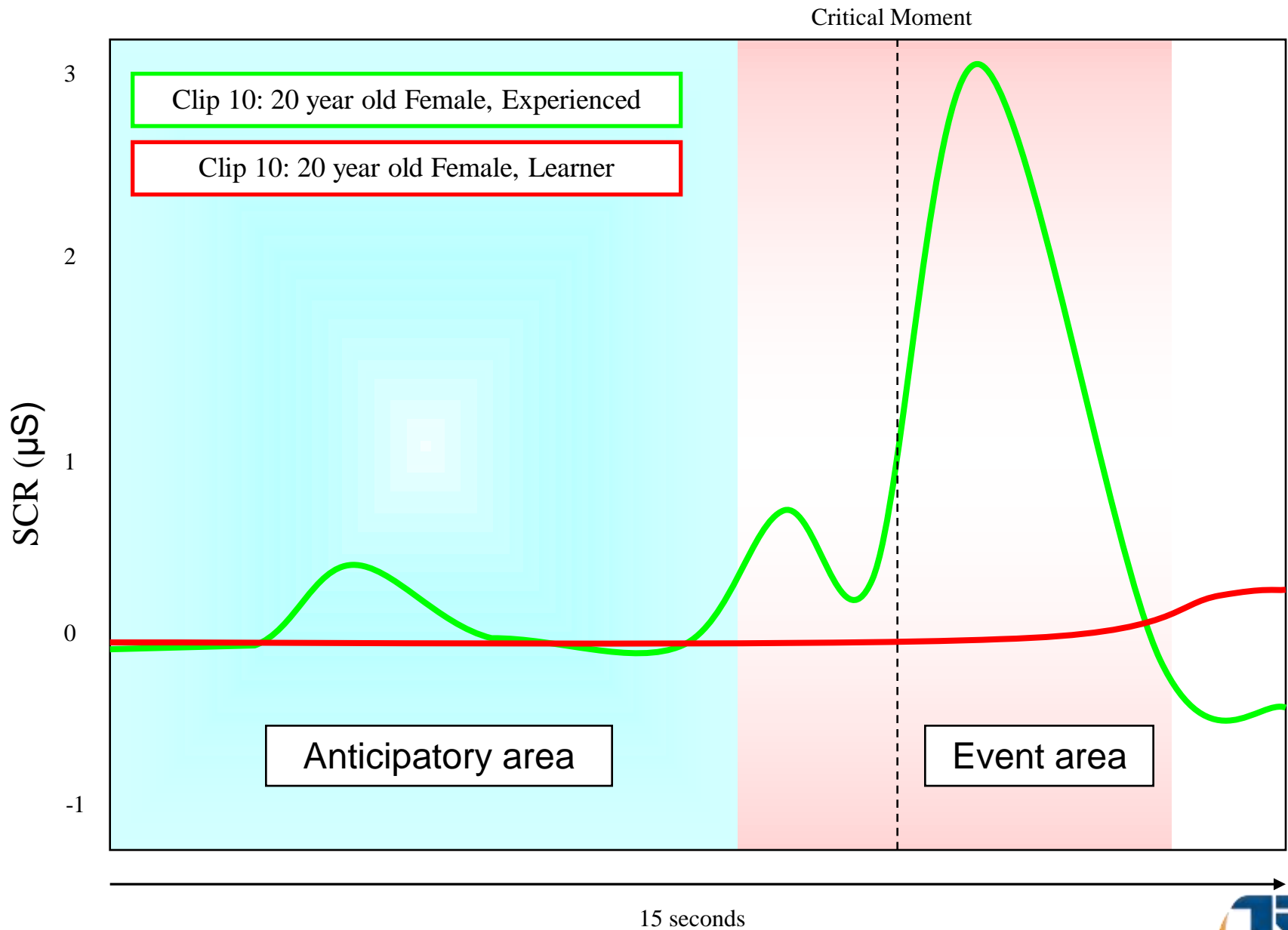
- “The field of judgement and decision making long neglected the influence of emotions and feelings on decision behaviour in favour of cold deliberative and reason-based decision making...However, over the last ten years the field has turned its attention more and more to how feelings influence judgements and decisions.”
- Feelings act as information to guide and bias judgement and decision processes. The feelings themselves are based on prior experience of situations.
- By translating complex scenarios into feelings, decision making can do without continuous conscious attention and reasoned logic.

Hazard Perception & Visual Scanning

What research tells us

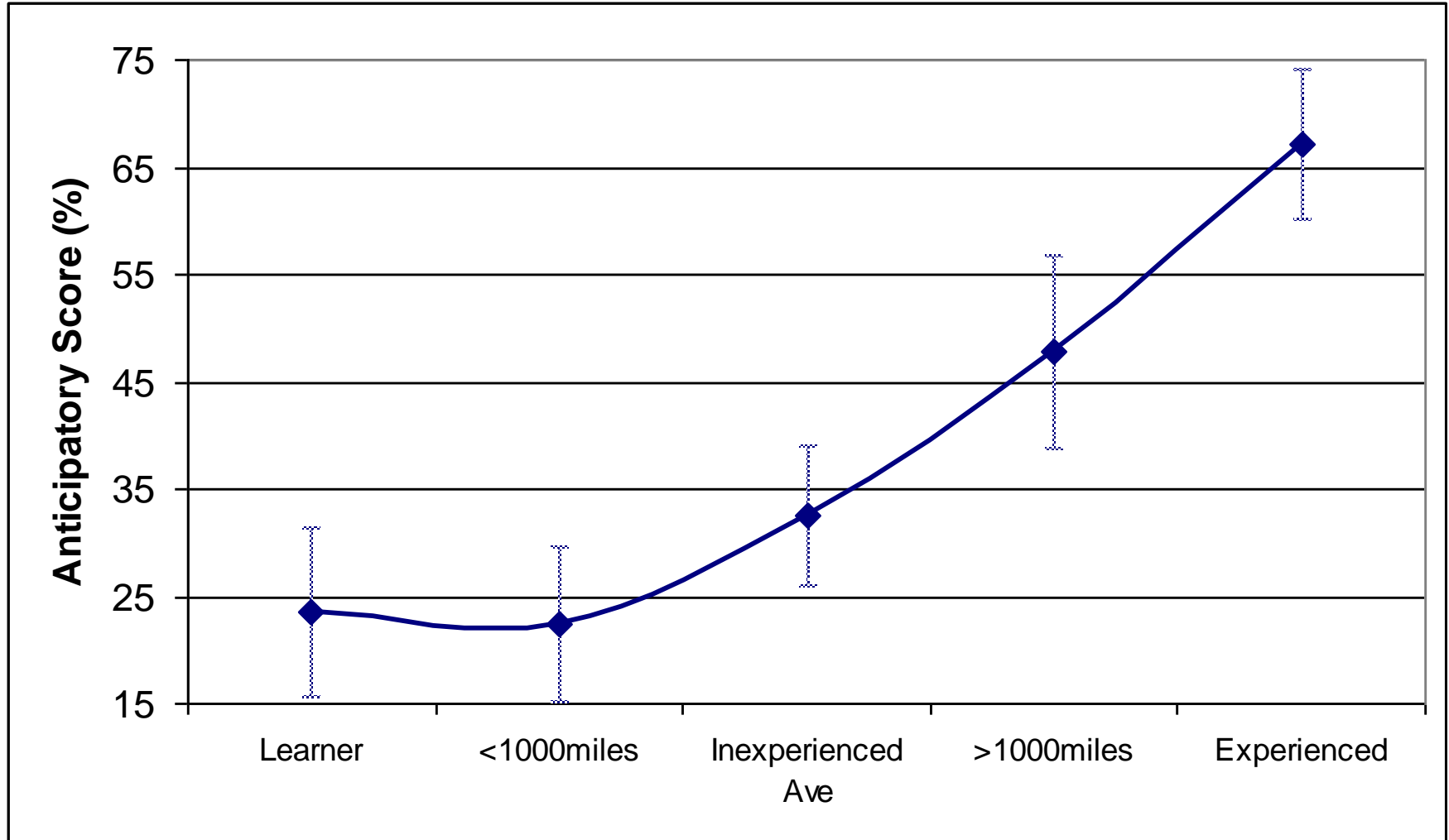
Novice drivers...

- Perceive less holistically
 - Perceive hazards less quickly
 - Perform smaller horizontal scans
 - Look closer to the front of the vehicle
 - Check mirrors infrequently
- Glance at objects infrequently
 - Utilise peripheral vision inefficiently
 - Fixate on fewer objects
 - Fixate more on stationary objects
 - Are more likely not to perceive a hazard at all



Experiment – DSA Hazard Perception clips

A learning curve?



Historical SCR and Driving Literature

- Hulbert (1957)
Michaelis (1960) Both reported that drivers demonstrated distinct measurable SCRs when driving and that they occurred relatively frequently
- Taylor (1964) Reported supporting Michaelis results that observable traffic hazards were related to increases in SCR activity
- Helander (1978) Inferred that SCR precedes the release of the accelerator by 0.2secs and the pressing of the brake by 1.9secs.

"it is obvious that mental activity that gives rise to SCR precedes muscle tension and brake application" p486

The A377 bend treatments study: using IVDR data to validate an approach to rural road safety



Background

- Devon County Council approached TRL in late 2009 to validate bend risk ratings
- Bend-related collision problem identified on the A377
- Part of DfT Rural Road Safety Demonstration Project
- Previous 2008 study recommendations:
 - Straighten some bends... ☹️
 - Inconsistent signing... 😊



Devon County Council approach

- Make signing and marking more consistent (based on Transport Scotland approach)
- Risk levels:
 - 1: No treatments
 - 2: Warning sign and edge lines
 - 3: As #2 plus 'SLOW' on road
 - 4: As #3 plus chevron
 - 5: As #4 plus high friction surfacing
 - 6: As #5 plus VAS

1.



2.



3.



4.



5.



6.



Assigning bend risk ratings (SCANNER)

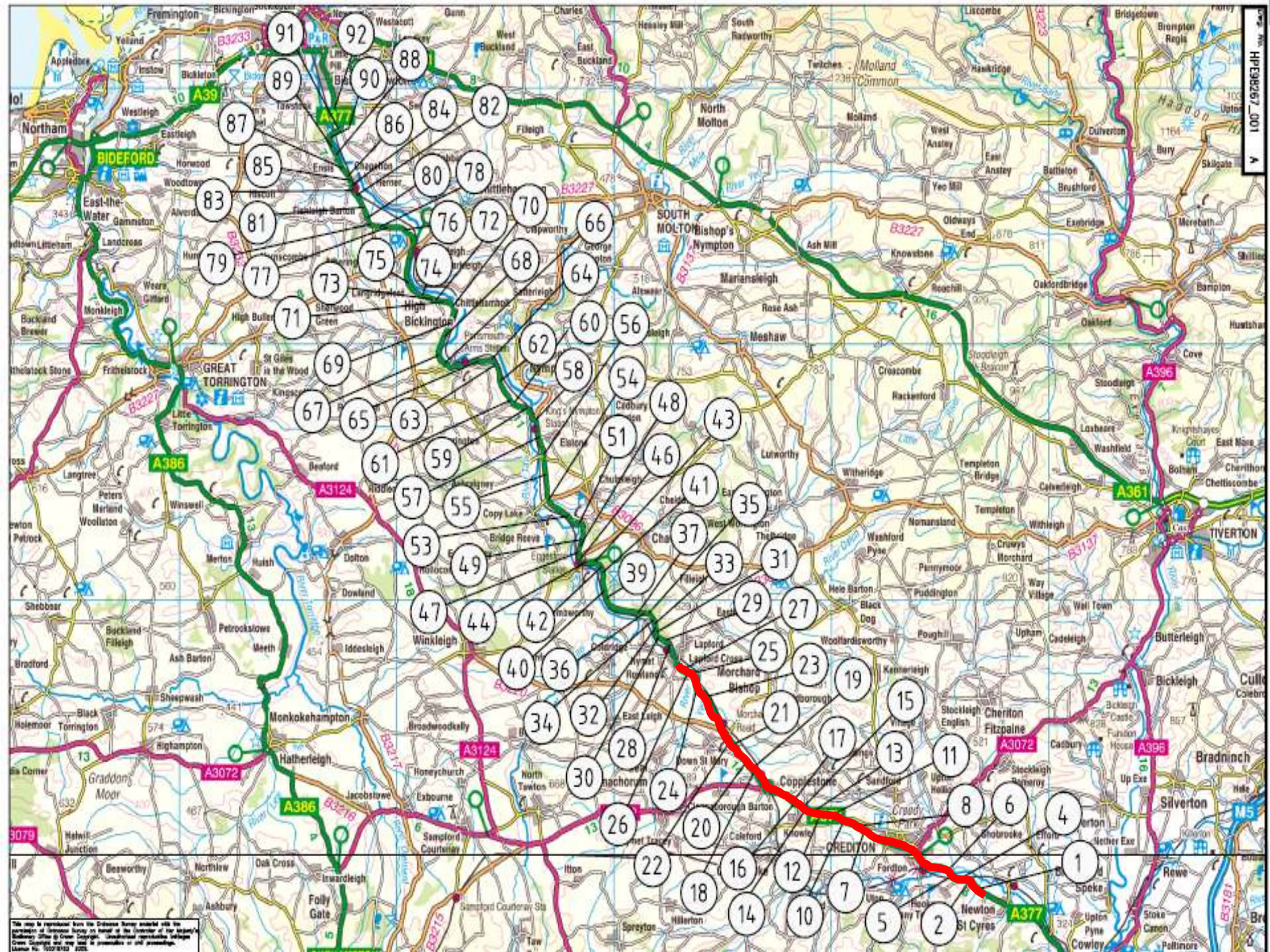
- Devon County Council's approach was to use bend geometry (and collisions) to assign risk scores to all bends on the A377
- The SCANNER survey machine measures a number of parameters continuously as it is driven along a route:
 - Gradient, Cross fall,
 - Radius of curvature,
 - OSGR Easting,
 - Northing, Altitude



DCC approach to using SCANNER data

- Bends with a national speed limit on A377 between Cowley Bridge and Bishops Tawton attributed score based on radius, cross fall and collision history.

Factor	Score
First assign a score based on radius of curvature:	
Radius less than 127m	5
Radius between 127 – 180m	4
Radius between 181 – 255m	3
Radius between 256 – 360m	2
Radius between 361 – 512m	1
Then add a score based on cross fall:	
Cross fall less than 2.5%	1
Finally add a score for each collision:	
Bend related collision within 100m of relevant bend (Fatal, serious or slight injury)	1



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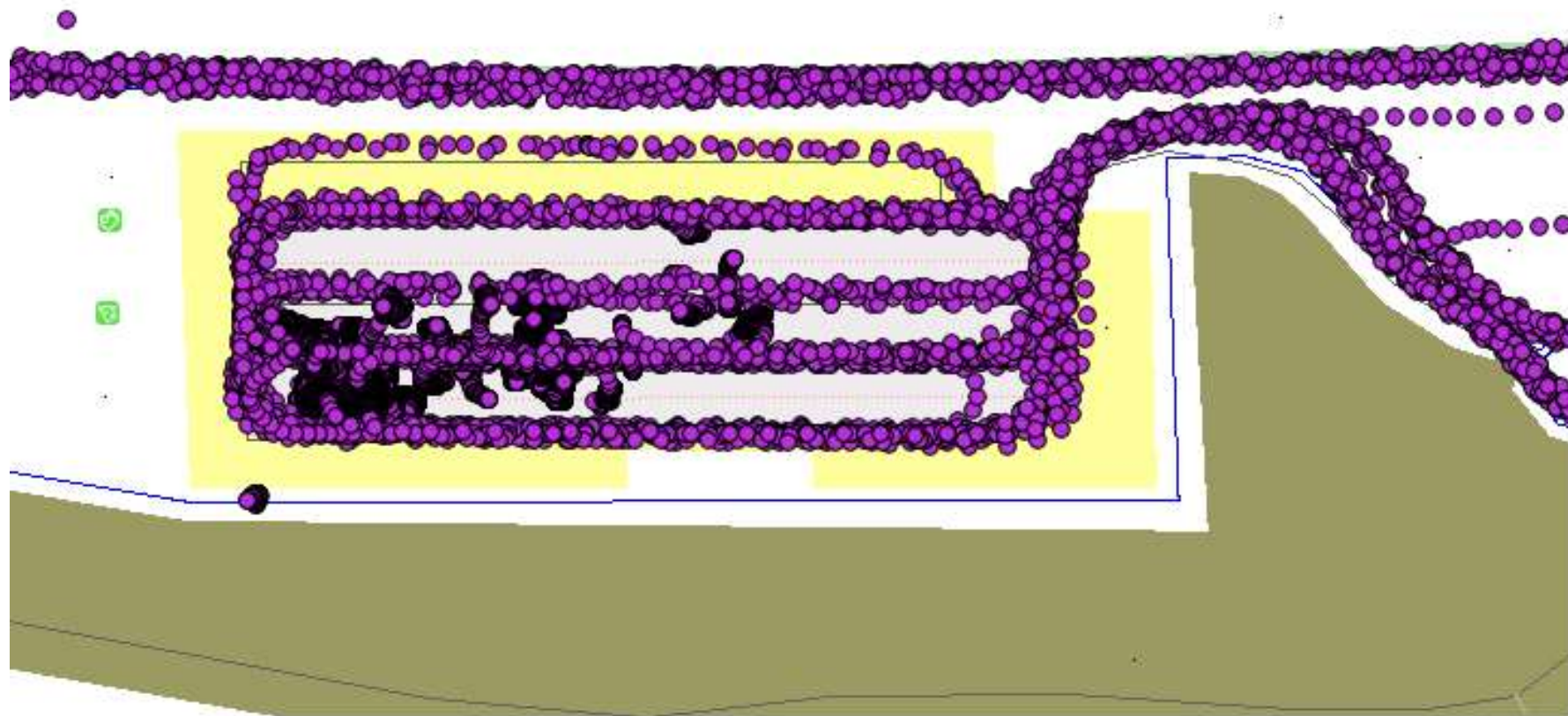
Bends in study area

Bend	Risk Score Northbound	Risk Score Southbound
1	9	8
2	4	4
4	7	7
5	4	4
6	5	5
7	4	3
8	5	5
10	6	4
11	6	8
12	7	5
13	2	3
14	2	3
15	2	3
16	6	7
17	1	3
18	3	3
19	3	4
20	4	3
21	3	2
22	1	3
23	4	4
24	7	6
25	6	7
26	5	4
27	6	5
Mean	4.48	4.52



SERIAL DB 06737

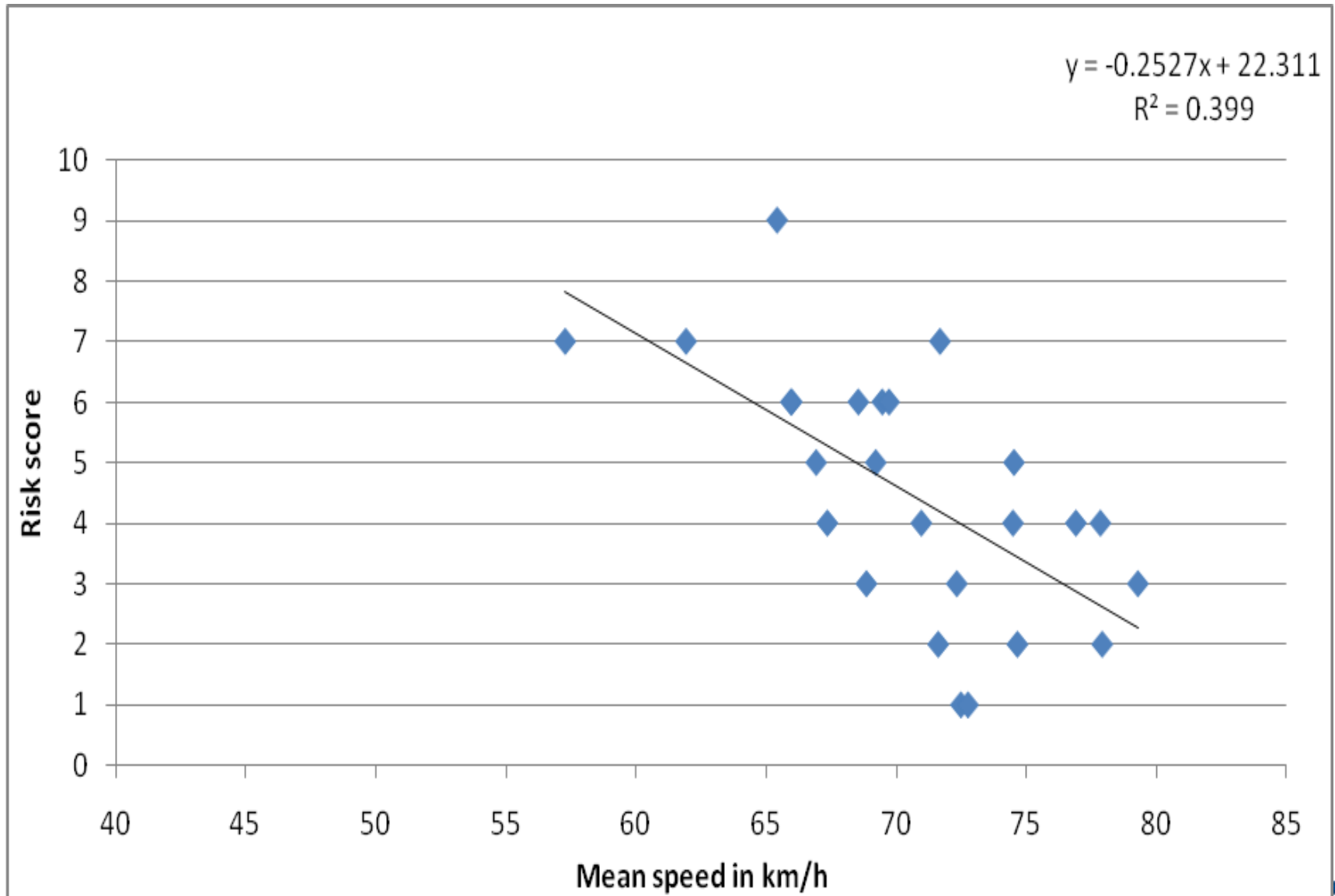
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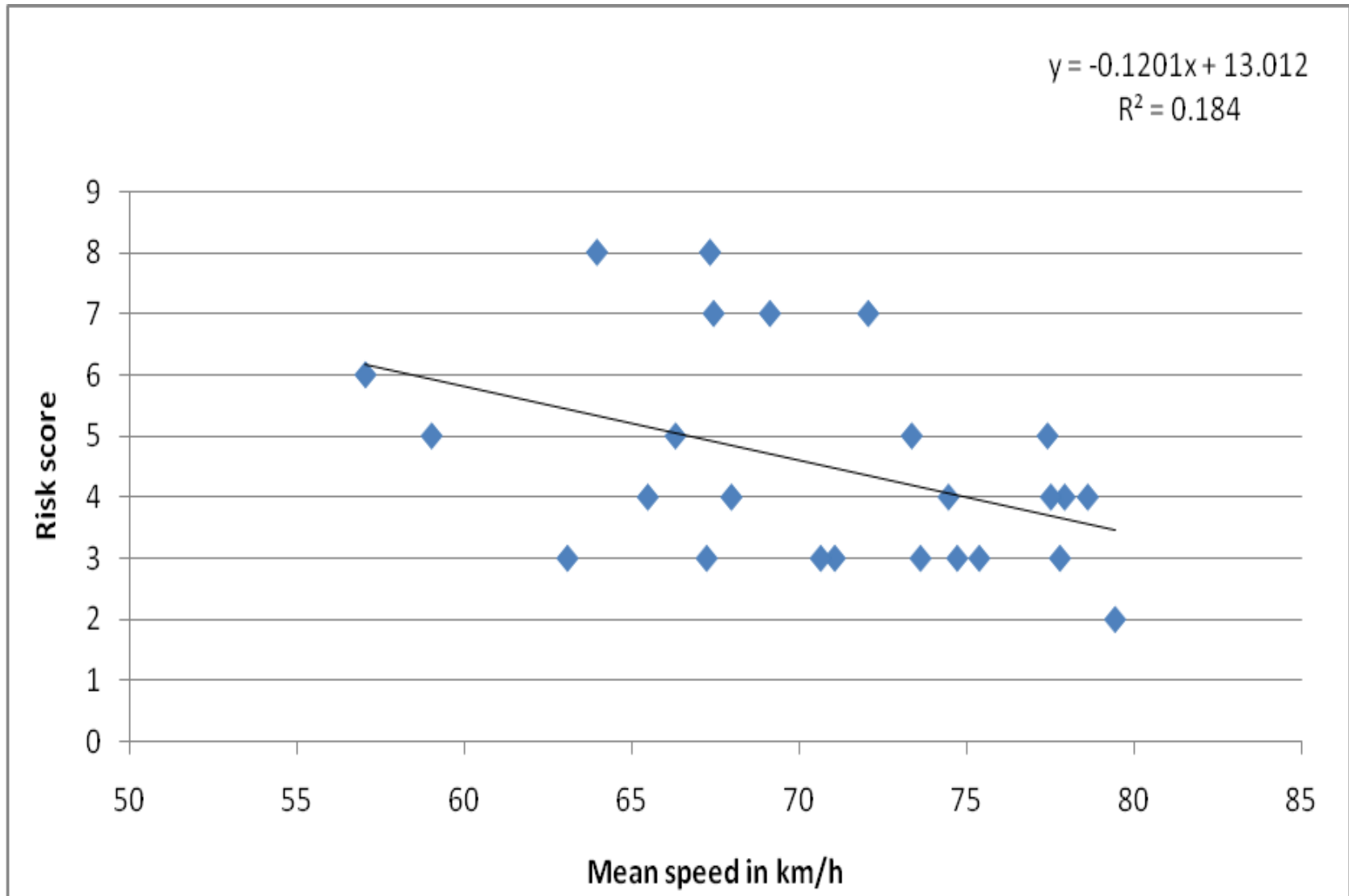
Research questions

- **How does driver behaviour on the A377 relate to bend risk scores?**
- Specifically – does driver speed choice on bends correlate (negatively) with risk score?
- Higher risk bends should be perceived as more demanding, and therefore drivers should slow down
- If it does, are there occasions when the relationship breaks down?
- Are there some bends that lull drivers into either a 'false sense of security' or a 'false sense of danger'?

Results – daytime northbound



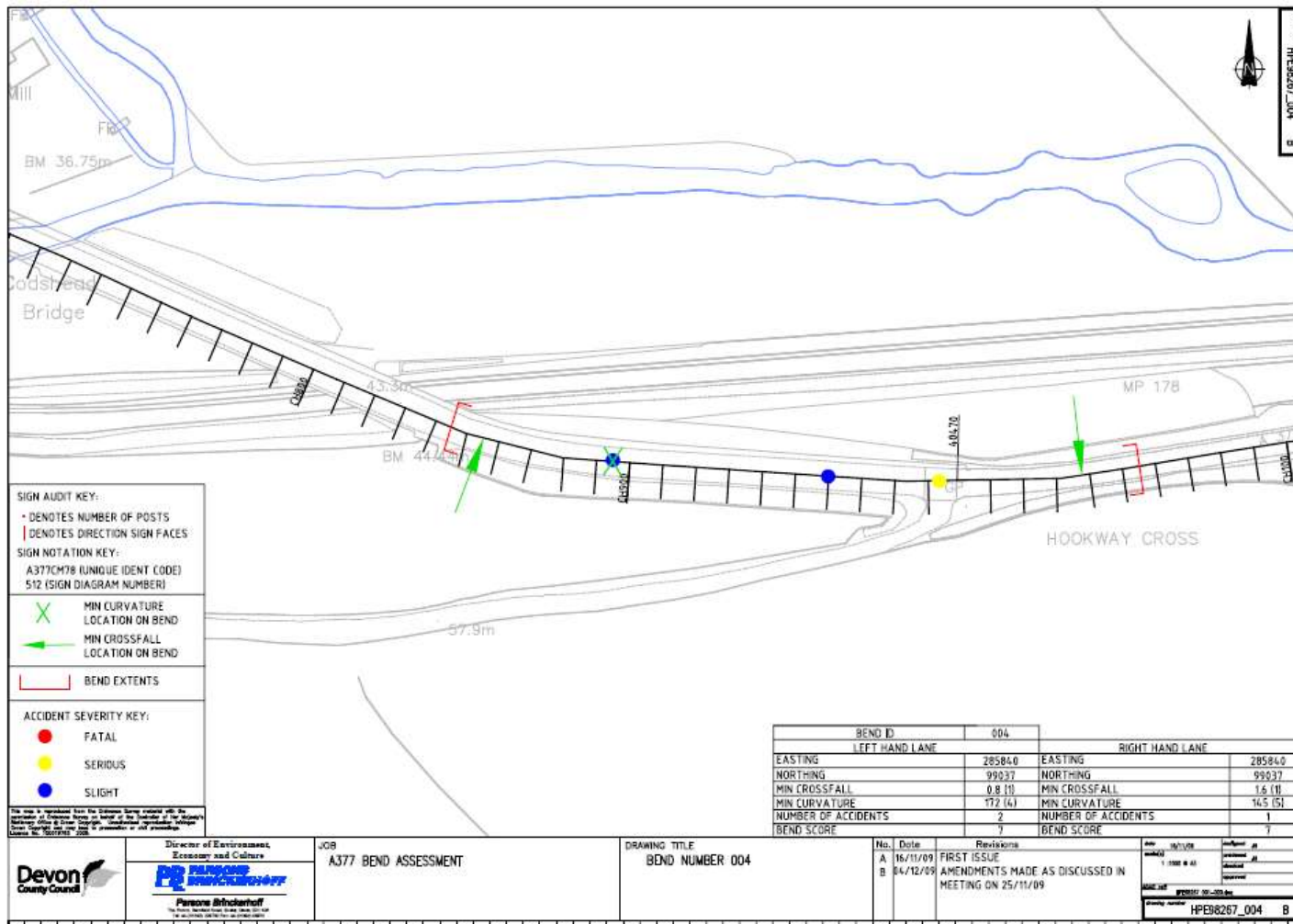
Results – daytime southbound



Further validation

- The DCC risk score, in its current form, might underestimate link with speed choice
 - Drivers cannot 'see' previous accidents
 - There are other features on bend that may communicate 'demand' or 'risk' (e.g. junctions)
 - There are also existing signs, lining etc.
- Therefore we coded all bends on the route from the drive films for the presence of these additional features and treatments.

	Daytime data		Night time data	
	Northbound	Southbound	Northbound	Southbound
Original risk score	-0.632 (0.399)	-0.429 (0.184)	-0.593 (0.352)	-0.464 (0.215)
Original risk score minus accidents	-0.652 (0.425)	-0.618 (0.382)	-0.599 (0.359)	-0.591 (0.349)
Original risk score minus accidents plus junctions	-0.659 (0.434)	-0.592 (0.350)	-0.600 (0.360)	-0.558 (0.311)
Original risk score minus accidents plus junctions plus existing treatments	-0.683 (0.466)	-0.778 (0.605)	-0.638 (0.407)	-0.711 (0.506)



- '2nd riskiest' on basis of original risk score
- 11th highest mean speed...

...but '7th riskiest' on basis of measure including geometry, junctions, treatments



Overall conclusions

Risk as feelings

- Modern theory in risk appraisal and decision making can improve our understanding of driver behaviour
- Drivers appear to translate sensations from their environment into feelings that guide decision making and behaviour, possibly in the absence of conscious awareness
- Validation of DCC's objective risk ratings suggests that factors from the road that will immediately feedback to drivers' perception of the environment influence driver speed choice
- Route treatments can be assisted by appreciating how drivers perceive risk as feelings

“Above all else, there is a current convergence in recognizing the primacy of the role of feeling in driver decision-making and this recognition opens up a whole new set of exciting and promising research questions.”

Fuller (2008)

Thank you

Presented by Dr Neale Kinnear

email: nkinnear@trl.co.uk

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