Theories of psychological research

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Humans are expected to deal with an immense amount of information whilst dealing with everyday

complex tasks such as driving at high speeds in variable weather conditions and road conditions. Yet,

research has shown that there is a limit to what humans can handle.

It is well documented that human error on the road causes minor injury to fatal accidents and even

damage. Treat et al (1977) calculated that human error is a major contributing factor in 90% of

accidents and was also the only factor in 57% of accidents.

This essay will consider two theories of psychological research on human memory. Attention and

perception that can be used to assist understanding of the cause of human error on the roads.

It will provide an overview of these two theories and the limitations in human information processing

that contributes to accidents. It will also consider human error and how the research mentioned can be

applied to minimise driver errors on the roads. It will conclude with a number of possibilities considered

to reduce human error.

Several studies noted that capacity of humans to process information is limited in capacity.

Green(1991)research confirms that the flow of information whilst undertaking everyday tasks as driving

is complex with the driver handling various information at the same time such as auditory and visual

input vehicles, pedestrians, road signs, weather conditions. There is a continuous demand on the

driver’s memory who is also handling other auditory information such as talking to other passengers,

listening to music, and recalling or recognising directions.

Information processing theory is used to explain the importance of attention. Several studies show that

accidents occur when the driver was focussed on something else. Several studies reveal that the driver

can carry put all of the above tasks if visual and auditory input is low. However, if there is an increase in

demand for attention when there is poor visibility or the driver is driving very fast, or driver is affected

by fatigue or alcohol then attentional capacity is reduced.

This limitation in capacity relates to bottleneck theories which suggests information enters the

awareness one at a time whilst the information capacity theories propose information is processed

through various channels, but each channel has a limited capacity. The driver does not have the capacity

for inputs; they can only pay attention to certain number of information.

Broadbent(1958), Treisman(1960) and Deutsch & Deutsch(1963) put forward the theories of selective

attention that remains influential, despite current theories focus on capacity theory, and the decay of

information explained by Baddeley & Hitch(1974).

Broadbent Filter Model theory is based on Atkinson and Shiffrin multi-store memory model (1968) that

explains memory processes and sequences stages; sensory, short-term and long term memory. The

research confirms that the driver processes two types of stimulus. According to Broadbent the input

comes through the filter and the other stimuli are held in a ‘ bottleneck’ for processing later.

Baddeley & Hitch (1974) working memory not only has limited capacity but also information decays,

this gives limitation in regards to new information being held. There is some difficulty with Filter model

Theory of attention. Cherry (1953) ‘ cocktail party effect’ experiment confirms the subject focuses

attention on interesting stimuli whilst ignoring other stimulus. Again, Treisman (1960) proposed that if

stimulus has meaning it can be processed, whilst Deutsch and Deutsch (1963) proposed that if stimulus

needs to be responded to it can be selected later.

The conclusion to be drawn from this, is that driver capacity to interact safely on the road is reduced

and the possibility of human error increases because of the demands placed on attention. With such

complex tasks as driving, information would not be retained or recalled, and as the capacity for inputs

are limited the driver can only pay attention to certain pieces of information, so information which

could be important could slip from memory. The issue remains of how to get drivers to focus their

attention fully on the road.

Human perception is another research area that can be applied to human error on the roads. Human

perception is based on context and expectations the bottom up and top down approach. Several studies

reveal that perceptual error jeopardise road safety. For example drivers often admit to not seeing visible

information such as pedestrians crossing the road. In addition drivers misinterpret information such as

speed or closeness to other vehicles. or drivers misread the speed or the closeness of other vehicles.

Mack & Rock (1992) researched visual perception of unexpected shapes whilst looking at it directly. This

phenomenon is called inattentional blindness or perceptual blindness. This phenomenon occurs when

subjects do not see visible objects in front of them. This can be for reasons such as overload of

information or their attention is focussed on something else that has meaning, or no internal reference to the visible object. Simons, Chabris

(2004) experiment on perception resulted in showing how subjects did not see an incident happening in front of them. This experiment involved participants playing basketball game and missing an unexpected appearance of someone dressed up in a white gorilla suit walk onto the ball court during the game. Subjects did not recall seeing the white gorilla.

Scholl et al (2003) research also suggests that auditory input such as talking on mobile telephone can increase the opportunity of a subject failing to notice the unexpected and leading to increased human errors.

This research on perception has implications for road safety, as drivers often report they did not see the

pedestrian or car in front. The driver focus on what they expect to see ‘ top down processing’ rather

than on the unexpected objects. This results in the likelihood of important and unexpected objects being

missed. Neisser (1976) suggests that is not either or for humans. Perception involves both top down and bottom up processing becoming a perceptual cycle.

Reason (1991) extensive research on human error defines error “ as circumstances in which planned

action fail to achieve the desired outcome.” Examples of this are stepping on the brakes too late and

failing to stop at red traffic lights. Norman & Shallice(1986) and Reason(1991)theory could be used to explain human error in driving tasks and knowledge. Norman and Shallice propose two types of control ‘ controlled control’ and ‘ automatic control’. Controlled control being within awareness, but conscious and limited and automatic control out of awareness, creates automacity in tasks already rehearsed over a long period of time. This become out of awareness and is performed without effort like driving.

Reason (1991) also suggests that there are 3 types of cognitive processes that cause errors.

- Skills based error or slips these consist of automatic action that was unconscious
- Rules based mistakes these consist of non-appliance of a heuristic to undertake a task
- Knowledge based conscious thought to solve a problem

Finally Reason (2000) Swiss Cheese Model of human error can assist in understanding how road accident

occurs. All slices of the cheese model have gaps which have to be aligned for an accident to occur. Thus

a combination of factors can cause human error. To reduce the chance of accident road experts could

use Reason model to identify the factors that contribute reducing unsafe acts such as talking on mobiles

whilst driving, visible multiple cues, signals, colour coding, speed limits and road examinations are some

of the examples observed to reduce road fatalities.

Conclusion

This essay has attempted to briefly explain the psychological research on memory that could be applied

to the road. It concludes that this research on attention and perception can help to understand the

cause of human errors on the road. However, memory research is still laboratory based, and opens to

criticism regarding ‘ ecological validity’. In deed human error is inevitable and getting humans to adapt

their behaviour may prove challenging.

References

- Treat, J, R, Tumbus, N, S, McDonald, S, T, Shinar, D, Hume, R, D, Mayer, R, E, Stanisfer, R, L and Castellan, N, J(1977) Tri-level study of the cause of traffic accidents report No. DOT-HS-034-3-535-7777(TAC)
- Green, M (1991) Visual Search, Visual streams and Visual architectures. Perception and Psychophysics, 50, 388-403
- Cherry, C (1958) some experiments in the recognition of speech with one and two ears, Journal of acoustical society of America, 25, 975-979
- Broadbent, D (1958) Perception and Communication London/New York, Pergamon Press

- Atkinson, R and Shiffrin, R(1968) Human memory: A proposed system and its control processes, In K, W Spence and J, T Spence(Eds) The psychology of learning & motivation (vol2) London Academic press
- Baddeley, A & Hitch, G (1974)Working memory in G Bower(Ed) The psychology of learning & motivation(vol 8)pp. 47-90 San Diego, Academic Press
- Treisman, A (1960) Contextual cues in selective listening. Quarterly Journal of Experimental Psychology, 12, 242-248
- Mack, A Rock, I (199) Inattentional Blindness Cambridge, MA, MIT Press
- Scholl, B Noles, N, Pashera, V, Sussman, R(2003) Talking on cellular phone dramatically increases sustained Inattentional blindness[abstract]Journal of vision, 3(9): 156, 156a
- Simons, D & Chabris, C(1999) Gorillas in our Midst: Sustained Inattentional blindness for dynamic events. Perception, 28, 1059-1071
- Reason, J(2000) Human Error, Models and management, British Medical Journal, 320 768-770
- Norman, D, A, Shallice, T(1986) Attention to Action: Willed and automatic control of behaviour in R. J. Davidson, G. E Schwartz and D. Shapiro(Ed)The design of everyday living, New York, Doubleday
- Neisser(1976)Cognition and Reality San Francisco, CA, W. H Freeman