



Belgisch **Wegen**congres Congrès belge de la **Route**

LEUVEN • 4-7.04.2022

Human centered design

Enseignements de la recherche comportementale pour la
conception des routes





Forgiving and self-explaining road design

- ▶ **Approche de systèmes sûrs => routes qui pardonnent (*forgiving road*)**
 - ▶ Minimalisation des conséquences des fautes du système (p.e. erreur humain, comportement dangereux, problèmes techniques du véhicule,...)
 - ▶ Traditionnellement: approche biomédicale, ingénierie
- ▶ **Autre principe important: routes auto-explicatives (*self-explaining road*)**
 - ▶ Différents types de routes supposent un comportement différent, adapté => routes doivent être construites de telle sorte qu'un comportement adapté et sûr soit suscité par l'environnement routier
 - ▶ Cf. Theeuwes & Godthelp (1995), Theeuwes (2021): SER comme principe directeur:
 - ▶ "roads should be designed in such a way that road users immediately know how to behave and what to expect on these roads"
 - ▶ "environment should be designed such that it elicits adequate and safe behavior"
 - ▶ "*the road nudges the right behavior* without the need for much enforcement or education.
 - ▶ Traditionnellement: ingénierie, urbanisme, sciences des transports
 - ▶ Étendu: sciences comportementales

▶

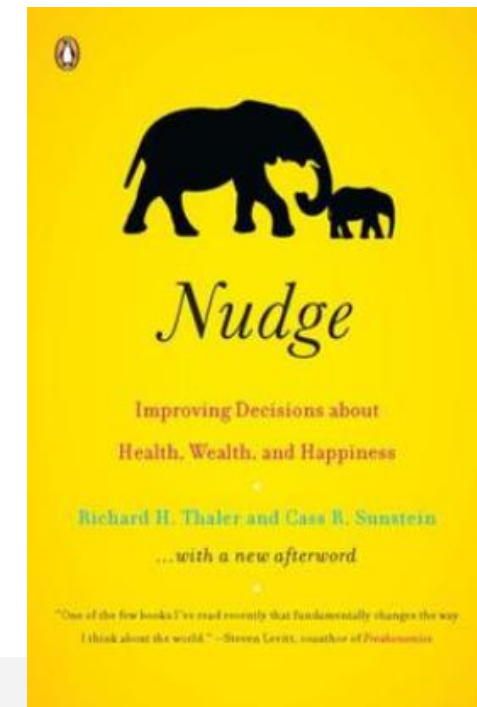
(1) Theeuwes, J., & Godthelp, H. (1995). Self-explaining roads. *Safety Science*, 19, 217–225.

(2) Theeuwes, J. (2021). Self-explaining roads: what does visual cognition tell us. *Cogn. Research*, 6:15



A road that nudges the right behavior

- ▶ Nudge/Nudging:
 - ▶ Thaler & Sunstein (2008): Nudge: Improving Decisions about Health, Wealth, and Happiness
 - ▶ Choice architecture that alters people's behaviour in a predictable way without restricting options or significantly changing their economic incentives
 - ▶ Altering the environment so that automatic [cognitive processes](#) are triggered to favour the desired outcome
 - ▶ Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not
- ▶ Contexte:
 - ▶ Behavioural economics (e.g. Kahneman, Tversky, ...)
 - ▶ individuals' choices in a wide range of contexts deviate from the predictions of rational behaviour. Some of these deviations are systematic, consistent, robust and largely predictable
 - ▶ Psychologie cognitive (e.g. Nisbett, Ross, ...)





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Exemples classiques



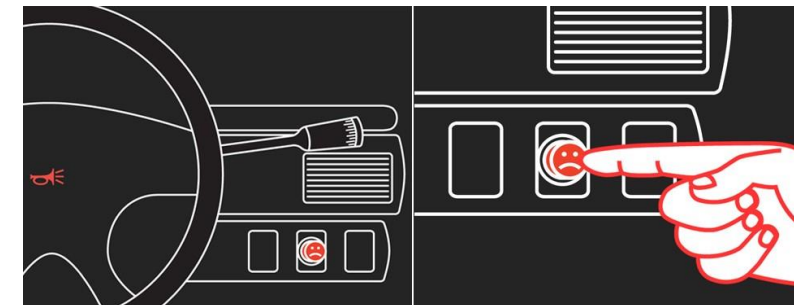
Would you like to proceed?

Yes

No thanks.



Autres exemples créatifs





Applications en sécurité routière (Avineri, 2014)



Journal of Economic Psychology
Volume 33, Issue 1, February 2012, Pages 264-277

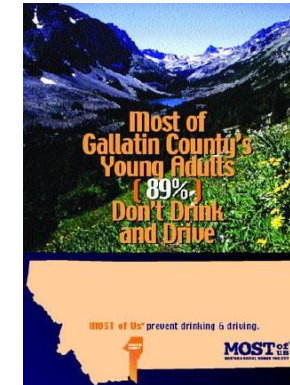


Influencing behaviour: The mindspace way

P. Dolan ¹*, M. Hallsworth ²*, D. Halpern ¹*, D. King ¹*, B. Metcalfe ¹*, L. Vlassov ²*, A. W.

Messenger	We are heavily influenced by who communicates information
Incentives	Our responses to incentives are shaped by mental shortcuts
Norms	We are strongly influenced by what others do
Defaults	We 'go with the flow' of pre-set options
Salience	Our attention is drawn to what is novel and seems relevant to us
Priming	Our acts are often influenced by unconscious cues
Affect	Our emotional associations can powerfully shape our actions
Commitments	We seek to be consistent with our public promises, and reciprocate acts
Ego	We act in ways that make us feel better about ourselves

► Social norms



► Defaults



► Salience





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Influencing behaviour: The mindspace way

P. Dolan ^a, M. Hallsworth ^a, D. Halpern ^a, D. King ^a, R. Metcalfe ^a, L. Vlaar ^a, J. A. B.

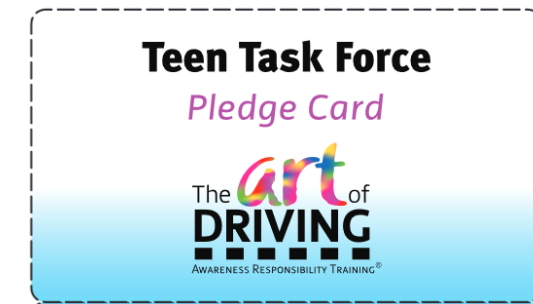
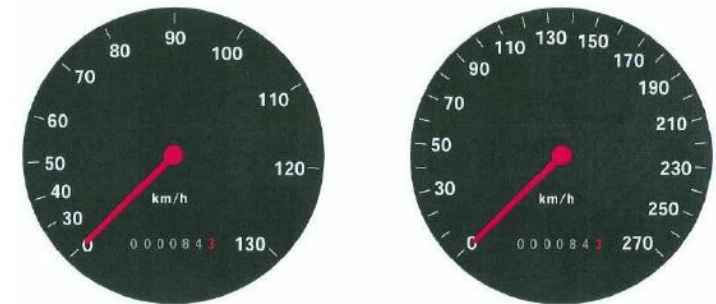
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► Priming

► Affect

► Commitments

► Ego



Applications en construction

► Speed reduction markings

$$L = v_1 * t_b + \frac{(v_1^2 - v_2^2)}{2a}$$

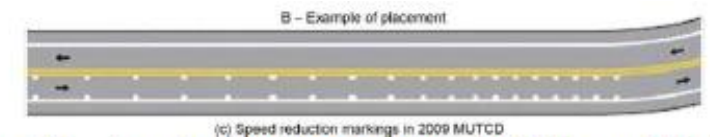
. EQUATION. DECREASING VELOCITY LINEAR EQUATION



Figure 22. Optical Speed Bars on South End of Lee Chapel Road Installation (Virginia, US).
 Top: View Looking North. Bottom: View Looking South.
 Source: Arnold and Lantz (2007).



Figure 21: The curve at Lake Shore Drive and Oak Street in Chicago.
 Image source: <http://nudges.org/?s=lake+shore+drive>



(c) Speed reduction markings in 2009 MUTCD
 Figure 24 – Speed reduction markings in China and the U.S
 Image source: Ding *et al.* (2013)

Autres exemples

- ▶ Converging chevron marking pattern
 - ▶ shown to reduce crashes by 43 percent
 - ▶ reduce 85th percentile speeds by 11 to 24 %
- ▶ Transverse markings
 - ▶ no high-quality safety evaluation available
 - ▶ marginally reduce 85th percentile speeds



- ▶ Optical speed bars



- ▶ Trees at decreasing distances apart



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Autres exemples qui pourraient illustrer *nudging* / *priming*



Figuur 3.18. – OFOS zonder toeleidend fietspad. Het toeleidend



Self-explaining roads: What does visual cognition tell us about designing safer roads?

Jan Theeuwes^{1,2*} 



How do roads elicit adequate and safe behavior? (Theeuwes, 2021)

- ▶ Theeuwes & Godthelp (1995)
 - ▶ self-explaining road = *“traffic environment which elicits safe behavior simply by its design”*
 - ▶ design and layout elicits automatically the behavior that is appropriate for that type of road
 - ▶ road nudges the right behavior without the need for much enforcement
- ▶ Background
 - ▶ driving involves hardly any conscious control and consists of skill-based components that are automatized
 - ▶ behavior can be triggered automatically by features in the environment
- ▶ Statistical learning
 - ▶ “selection history” may represent a much more important factor affecting visual selection
 - ▶ cognitive machinery is tuned to the structured properties of the environment, such that given a particular context, our senses “expect” particular input at a particular time and particular place

Self-explaining roads: What does visual cognition tell us about designing safer roads?

Jan Theeuwes^{1,2*} 



How do roads elicit adequate and safe behavior? (Theeuwes, 2021)

- ▶ Statistical learning and self-explaining roads
 - ▶ drivers learn to expect particular objects in particular locations
 - ▶ learned objects to co-occur and expect critical objects and hazards in appropriate locations and moments in time
 - ▶ learned to expect road elements (signs, lights, markings) and road users (cars, bikes, pedestrians) at particular locations within specific road categories (highway, rural road, city roads)
 - ▶ if road environment well designed (i.e., expectations not violated), road is *self-explaining*
- ▶ Implications for road design
 - ▶ when roads are clearly recognizable, road users categorize similarly and only then this results in homogenous expectations and behavior
 - ▶ if road environment is heterogeneous, drivers are unable learn consistencies, resulting in inconsistent categorization and heterogeneous behavior



Model and applications (Theeuwes, 2021)

SER should be easily

- recognizable (same function, similar look)
- distinguishable (different function, different layout)
- interpretable (It should be clear from the design what the desired behavior should be on that route. The road characteristics should induce this type of behavior.)

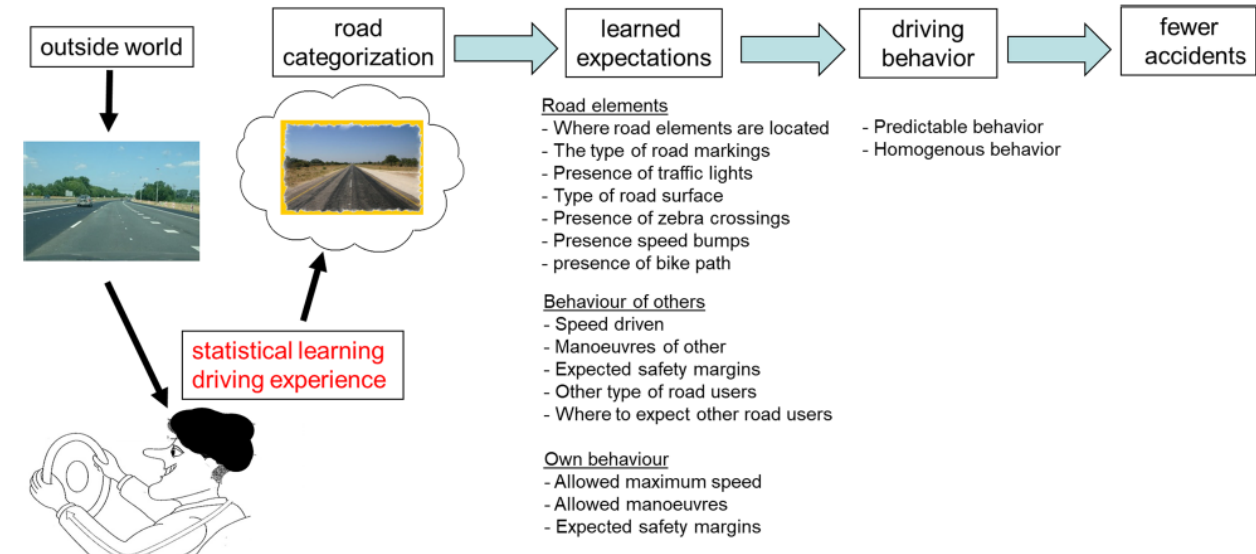


Fig. 2 Examples of roads in the Netherlands that are difficult to categorize. On the left is a picture of a motorway/freeway (A44) without crossing

Remarques finales

- ▶ Des routes auto-explicatives devraient automatiquement susciter un comportement adapté: "the road nudges the right behavior"
- ▶ Nudging: "without restricting options or significantly changing their economic incentives"
- ▶ Le principe SER: la conception de la route devrait clairement mener au comportement souhaité. Les caractéristiques de l'environnement routier devraient susciter le comportement désiré
- ▶ Interprétation de "conception qui suscite le comportement adapté" ne devient pas entièrement claire
 - ▶ Explicitement inclus:
 - ▶ Conception de l'environnement routier doit répondre au mieux à une catégorisation correcte et aux attentes
 - ▶ L'environnement dans sa globalité doit être conçu en vue du comportement souhaité
 - ▶ Laissé implicite ou pas inclus:
 - ▶ Interventions qui rendent un comportement dangereux impossible
 - ▶ Des mesures éducatives et au niveau de la politique criminelle (contrôle/répression) restent nécessaires





UNE ORGANISATION



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Belge de la Route



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Centre de
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SERVICE PUBLIC RÉGIONAL DE BRUXELLES



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