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The restless mind while driving: drivers' thoughts behind the wheel

Gaëlle Berthié [a], Céline Lemercier [a,*], Pierre-Vincent Paubel [a], Maurice Cour [b], Alexandra Fort [c], Cédric Galéra [d], Emmanuel Lagarde [d], Catherine Gabaude [c], Bertrand Maury [e]

[a] Université de Toulouse, France _ CLLE (Cognition, Langues, Langage et Ergonomie); UTM, EPHE, CNRS, 5 allées Antonio Machado, 31058 Toulouse Cedex 9, France
[b] Continental, 1 Avenue Paul Ourliac, 31100 Toulouse, France
[c] IFSTTAR-TS2-LESCOT, Laboratoire Ergonomie et Sciences Cognitives pour les transports, 25 Avenue François Mitterrand Case 24, 69675 Bron, France
[d] INSERM, 146 rue Léo Saignat, Bâtiment TP Zone Sud 4ème étage, 33000 Bordeaux, France
[e] Université Paris Sud Laboratoire de Mathématiques, bâtiment 425, Faculté des Sciences d'Orsay, Université Paris-Sud 11, 91405 Orsay, France

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ABSTRACT

Recent research has clearly shown that inattention when driving has an indisputable impact on road safety. "*Mind wandering*" (MW), an inattentional state caused by a shift in attention from the ongoing task to inner thoughts, is not only frequent in everyday activities but also known to impact performance. There is a growing body of research investigating the concept of MW, suggesting potential causes that could foster such a phenomenon. Only one epidemiological study has focused on this issue in a critical driving context (Galéra et al., 2012), and it revealed the harmful effects of MW in increasing the risk of a car crash. Experimental studies rather consider that driver would adduce in MW (Lemercier et al., 2014). When the driving context is too hard or the thought too difficult to proceed, driver reduced their MW. The aim of this paper is to examine this issue using the most recent trip of ordinary drivers whose MW state did not lead to a road accident. Using a questionnaire, information was collected about the participants' most recent trip as a driver, including: (1) personal characteristics, (2) context in which MW occurs, (3) awareness of MW episodes and finally (4) characteristics of the thoughts.

Results: revealed that MW affected 85.2% of the drivers, who spent on average 34.74% of their trip in a MW state. Moreover, we found that the contexts which favor MW are situations in which less of the driver's attention is needed to drive, such as familiar commutes, monotonous motorways or by-passes, or when drivers were alone in their cars. In these MW situations, the drivers quickly became aware of their MW episodes. Thoughts tend to involve neutral private concerns, related to present- or future-oriented content.

Our findings suggest that MW is a functional state aiming to solve current problems. Future investigations should focus on this critical concept of MW when driving, both to identify safety issues and to provide suitable solutions for drivers subject to a wandering mind.

1. Introduction

1.1. What is mind wandering?

For decades, epidemiological studies have indicated that drivers' inattention has an indisputable impact on road safety, responsible for about 25% of car crashes (Mosedale et al., 2005). Among the states of inattention in car, the processing of "*task-unrelated thoughts*" (e.g., Smallwood et al., 2003) or "*mind wandering*" (MW) is assumed to cause a redirection of attention from the current activity to inner thoughts (Lee et al., 2008; Lemercier and Cellier, 2008).

Considered to be prevalent in daily life (representing half of our daily thinking time according to Killingsworth and Gilbert, 2010), mind wandering has been mainly studied during laboratory tasks (Baird et al., 2011, 2012) and more infrequently during everyday activities like driving. For the moment, a few numbers of articles have investigated the influence of MW on driving performance. Conducted by He et al. (2011), the very first study revealed a change in the driver's visual scanning of the road during MW episodes. In a study inducing MW during a simulated trip, Lemercier et al. (2014) showed a reduction of the micro regulations of the lateral position when drivers proceeded distractive thoughts. They also demonstrated that when distractive thoughts

* Corresponding author at: Laboratoire CLLE-LTC, Université Toulouse le Mirail, 5 allées Antonio Machado, 31058 Toulouse Cedex 9, France. Tel.: +33 561503533.
E-mail address: celine.lemercier@univ-tlse2.fr (C. Lemercier).

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necessitate too many resources to be handled, then drivers focus their attention on the driving activity. These very valuable initial results beg the more general question of the conditions stimulating MW episodes during driving, i.e., are there any particular individual or contextual driving characteristics that tend to trigger MW episodes? And finally, what do the drivers perceive of the consequences of a wandering mind on the ongoing task? Which individual and contextual factors influence MW occurrence?

Very few studies have focused on the relationship between individual characteristics and the occurrence of MW episodes. Of those that did, the longitudinal study conducted by Giambra (1993) asked participants aged from 24 to 71 years to assess the frequency of mind-wandering episodes in their daily life at 6- to 8-year intervals using the daydreaming frequency scale. Results revealed a decline in self-rated MW episodes between the first and second evaluation, implying that the younger individuals are, the more frequently the MW episodes occur. Moreover, the authors demonstrated a sex effect on the self-reported frequency of MW episodes, with women tending to have fewer MW episodes than men. Cunningham et al. (2000) also showed the impact of individual expertise on the frequency of MW episodes. During an experimental detection task lasting 40 min, participants had to report each MW episode experienced. Analysis revealed a significant increase in MW episodes between the first 20 and last 20 min of the task. Authors concluded that the mind wanders depending on the degree of expertise that participants have in the task. Detection tasks (such as visual search tasks), also known as reaction time tasks, are considered to demand little attention, and easily become automatic. Familiar situations or monotonous tasks requiring few attentional resources would thus foster the occurrence of MW episodes. Working on the contextual causes of MW, Baird et al. (2012) confirmed this hypothesis. They found that participants performing tasks demanding little attention reported significantly greater MW episodes than participants performing tasks with a high attentional demand.

In the field of driving, such results infer that experienced drivers—i.e., those who have held their driving licence for more than five years, and who drive more than 20,000 km per year—should report more frequent MW episodes than novice drivers, the driving task being more automatic for them than for others. In the same vein, driving alone or with passengers (or talking on the phone while driving) should also impact MW. Talking with a passenger (or somebody on the phone), or just following a conversation, is considered as a situation of divided attention, leading to an increase in the driver's mental workload (Recarte and Nunes, 2000, 2003). We could expect a decrease in MW episodes in these situations. Finally, regarding the literature, the type of trip (daily vs. new), and type of road (in town vs. on a motorway) could also affect MW. In the very first part of the survey analysed in the present paper, we were therefore interested in all the individual and contextual factors of MW during driving.

1.2. Consequences of MW episodes on ongoing task performance

Only two studies were interested precisely in the impact of MW on driving. The first one was that conducted in the USA by He et al. (2011). In their simulated driving experiment, they studied the consequences of MW episodes on driving performance. Results indicated that when their minds wandered, drivers drove closer to the kerb (right-hand side of the lane in this case), decreased variations in speed, had dilated pupils and narrowed their horizontal field of visual scanning. The second one was that conducted in France by Lemercier et al. (2014). They demonstrated that drivers reduced significantly the micro-regulation of their lateral position when they were in MW episodes. However, and more interestingly, they showed that when the content of the distractive thought were too difficult to proceed, then drivers adduce to focus in the driving task and gave up their MW. So, the variation in driving performance during MW episodes could be interpreted as an adaptation to the driving context rather than degradation in the driving monitoring.

In a recent study conducted by Song and Wang (2012), 60.11% of individuals were aware of their MW episodes. A number of related questions are worth asking about this issue of awareness. First of all, how do drivers notice that they are currently thinking about something unrelated to the ongoing driving task? Do contextual or temporal events act as cues for awareness? Second, do drivers feel the impact of MW on their driving performance? And finally, which functions are affected by such a state?

1.3. Characteristics of off-task thoughts

A recent epidemiological study showed that highly distracting MW thoughts are related to a higher risk of being involved in an accident (Galéra et al., 2012). In this study, the drivers were asked to report their level of commitment to thoughts unrelated to driving that they had just before a car crash. Results revealed that a highly distracting content significantly increase the risk of causing a car accident. This result suggested that certain off-task thoughts are more intrusive (or distracting) than others, and so raise the question of the characterization of off-task thoughts.

A partial response is given in the study by Baird et al. (2011). Investigating MW with a probe-caught method during a reaction time task, the authors showed that off-task thoughts were frequently future-oriented, with the goal of personally planning relevant future goals or solving problems. This suggests that MW is a functional state, dedicated to prospective memory or planning future actions (Ellis, 1996).

1.4. Aim of the paper

The aim of the present paper is threefold. Firstly, it attempts to reveal the individual and contextual characteristics of driving linked to a MW state. Secondly, it aims to describe the behavioral consequences of MW on driving. Finally, it attempts to determine the characteristics of off-task thoughts while driving, using an original method of investigation of MW by an off-line questionnaire (filled out by participants just after their latest trip). This third goal is of methodological nature.

The very specific field of activity in which we investigated MW required finding a new methodology for measuring MW. The traditional methods currently used to evaluate MW are on-line, resulting in participants dividing their attention between their ongoing task and the MW reporting task. The safety risk associated with the addition of a secondary task while driving being significant, we could not use either probe-caught or self-caught methods of investigation (Smallwood and Schooler, 2006). The probe-caught technique entails stopping participants during the experiment so that investigators can assess if their mind wandered, while the self-caught technique entails participants reporting MW episodes as soon as they become aware of them. The off-line questionnaire method was thus constructed. It has the undeniable advantage of being unintrusive. However, it also has the indisputable disadvantage of focusing only on MW episodes of which the driver is aware.

2. Method

2.1. Participants

191 drivers were recruited via the facebook group "Experience en ligne Psychologie" (On-Line psychology experiment; managed