Effects of Anger and Sadness on the drivers' useful visual field: toward a tunnel vision phenomenon?

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Abstract

The useful visual field (UVF) is defined as the area around the fixation point from which information is briefly stored and interpreted during a visual task. It corresponds to the part of the peripheral visual field around the fixation point inside which sources of information can be processed without any movement of the eyes or the head. It is determined while carrying out a dual task (detection in the central part and the peripheral part on the visual field). The UVF is assessed on the basis of the number of signals detected in the peripheral task in which the participant has to detect the presence of a signal located at different eccentricities in his visual field. The drivers' UVF can be influenced by internal factors causing a tunnel-visionlike phenomenon. Here, the influence of anger and sadness on the UVF is studied. The results revealed a positive effect of anger: better detection in the central task without decreasing the detection in the peripheral task. Secondly, a tunnel-visionlike phenomenon was also observed in sadness. A classification of these emotions in the inattention taxonomy is discussed.

Introduction

The useful field of view was firstly defined by Mackworth (1965). It is the area around the fixation point from which information can be briefly identified and stored during a visual task. This field corresponds to the part of the peripheral visual field around the fixation point inside which sources of information can be processed at a single glance, i.e. without any movement of the eyes or the head (Ball et al. 1988, Sanders 1970, Scialfa et al. 1987). The useful visual field is evaluated during a dual task in which participants have to detect signals in the central part of the visual field and to detect concomitantly signals appearing at different eccentricities in the peripheral part. The useful visual field is therefore evaluated on the basis of the performance obtained in the peripheral task. The extent of the useful visual field has been assessed in several studies and particularly during driving. Previous studies have shown that the size of the useful visual field can vary, depending on the attentional demand. Indeed, several studies have shown that the visual field of view can vary as a function of the traffic density

(Crundall, Underwood & Chapman 1997), the use of a telephone (Pachiaudi et al. 1996), the speed of the vehicle (Bartmann, Spijkers & Hess 1991), and individuals' characteristics, such as age. For example, age can decrease this visual field (Ball & Oswley 1993) in the sense of a tunnel vision phenomenon. It means that the ability to detect peripheral signals in a dual task decreased with age, and that older people detects less peripheral signals than younger people. This difference is more pronounced as the eccentricity of the signal to be detected increases. Roge & Pebayle (2009) observed in particular the deterioration of the useful visual field with ageing and its consequences for road safety. In this study, the data revealed that age interacted with the location of peripheral signals and that the visual field deteriorates with age with the development of tunnel vision whatever the density of traffic. Moreover, it seemed that the tunnel vision phenomenon induced by ageing was not compensated by the level of driving experience. Other studies developed by Williams (1988) found evidence of a tunnel-visionlike phenomenon while manipulating the foveal load (matching between the stimulus of the central and the peripheral tasks) and the instructional set (priority given to one or to the two tasks) which attempted to bias participants' allocation of attention (focus or distribution of attention). In this study, the author manipulated also speed stress which was induced by the vocal intonations of the experimenter while reading the instructions. Williams found evidence of a tunnel-visionlike phenomenon when a central biasing (focused attention) instruction was linked to a difficult foveal load.

If ageing or speed stress could affect the useful visual field, what about personal factors like basic emotions?

Previous research have already demonstrated that negative emotions can decrease the available attentional resources (eg, Ellis & Ashbrook 1988) because of the presence of internal thoughts and ruminations. Effects on the information processing can differ from negative moods, such as sadness and anger. As an example, sadness is thought to promote the use of a detail-oriented processing of information (Bless et al. 1996). The authors then supposed that subjects in negative mood leave their minds wandering, rather than focusing their attention on the task. Ellis and Moore (1999) supposed that negative moods can lead subjects to develop irrelevant thoughts and therefore decrease their attentional resources. They supposed that the emotional states regulate attentional capacity. The lower capacity of the attentional resources are due to the fact that some attentional resources that would normally be used to perform the task are impacted by irrelevant thought in depression or negative mood such as sadness. Moreover, the authors assumed that attentional resources depends on many factors such as personality, age, or level of expertise and several studies have confirmed this assumption of limited capacity. Thus, both depression and anxiety seem to be associated with a reduced ability to perform complex cognitive tasks (Eysenck & Calvo 1998, Eysenck & Calvo 1992, Mueller 1992). In a driving context, these internal thoughts affect the driver's ability to appropriately process the road environment information (Lemercier & Cellier 2008). But negative emotions do not impact cognitive processes in the same manner.

Thus, the processing of information during anger differs from those associated with other negative moods such as sadness, and are more consistent with those pertaining to positive mood (Lerner & Tiedens 2006). Thus, Pêcher, Lemercier, and Cellier (2009) showed that angry drivers drove more like happy drivers than sad drivers. Other studies explained that angry participants rely more on their general knowledge and perform preferentially a top-down processing of information as participants induced in happy mood (Gilet & Jallais 2011, Lerner et al. 1998). Moreover, several studies have suggested that arousal may also increase the duration of attentional focusing on the arousing stimuli, thus delaying the disengagement of attention from it and prioritized its processing (Fox, et al. 2001).

The differences observed on the cognitive processes between negative emotions could also be interpreted within another framework. Emotions are defined along two orthogonal dimensions: the valence (the hedonic value of a mood state) and the arousal. Whereas anger and sadness are both defined by a negative value of the valence, they could be disentangled on their level of arousal. This dimension is defined either as the intensity of an event ranging from very calming, relaxing to highly exciting (e.g., Kensinger & Schacter 2006, Russell 1980), the perception of arousal associated with an emotional experience (e.g., Feldman 1995) or as a level of vigilance or activation (e.g., Revelle & Loftus 1992). Thus, sadness is defined with a low level of arousal and anger with a high level of arousal. The difference obtained along the arousal dimension concerning the effects of negative emotions on attention could make us think that these two emotions could impact the useful visual field in a different manner.

Several studies already showed that emotion can lead to inattention (e.g., Lemercier & Cellier 2008). Inattention can be defined as occurring (Craft & Preslopsky 2009: 3):

> "when the driver's mind has wandered from the driving task for some non-compelling reason" such as when the driver is "focusing on internal thoughts (i.e., daydreaming, problem solving, worrying about family problems, etc.) and not focusing attention on the driving task"

Regan et al. (2011) detailed in their taxonomy the different forms of drivers' inattention. Among all the categories, two could be linked to internal factors such as negative emotions. The Driver Neglected Attention (DNA) which is defined by Regan et al. (2011: 1775)

> "insufficient or no attention to activities critical for safe driving brought about by the driver neglecting to attend to activities critical for safe driving"

and the Driver Restricted Attention (DRA) which corresponds to

> "insufficient or no attention to activities critical for safe driving brought about by something that physically prevents (due to biological factors) the driver from detecting (and hence from attending to) information critical for safe driving".

As previously presented, the effects of attention are not the same along the negative emotions. We wonder if the negative emotions could belong to the same category along the taxonomy proposed by Regan et al. (2011). The effects of anger and sadness on the useful visual field could help us to categorize these emotions in the taxonomy.

If no deterioration of the useful visual field is observed in anger, we will think that anger belongs in the DNA category. Because of the ruminations and the prioritized processing linked to anger, inattention is brought by the fact that drivers even if they have sufficient available attentional resources, are not focused enough to activities critical for safe driving.

If the detection of peripheral signals decreases during sadness (in the sense of a general interference or a tunnel vision phenomenon), the effect of this emotion will belong to the DRA category. Indeed, if sadness can shrink the useful visual field, it is because of a biological factor that prevents driver to pay attention to information critical for safe driving. So, we assume that, because of the internal thoughts that could lead to inattention during sadness, drivers should have difficulty to detect peripheral signals. Participants induced in sadness should detect less peripheral signals than participants induced in anger.

Thus, we assume that sadness will lead to a reduction of the useful visual field in the sense of a tunnel vision. And, we suppose that, because of the high level of arousal in anger and the weak impact on attentional resources, the participants induced in this emotion will detect more peripheral signals than the control group (no emotion induced).

Method

Participants

53 drivers (age: M = 23.6, sd = 3.27, 38% male) were randomly assigned to one of the three conditions of mood: 17 were induced in Anger, 15 in Sadness, and 21 in a neutral mood (control group) using the music + guided imagery Mood Induction Procedure (MIP) (Mayer et al. 1995). All participants reported driving at least 10 000 km per year, had normal or corrected-to-normal eyesight, and performed the task individually.

Stimuli

We used a modified version of the paradigm previously developed by Rogé et al. (2002). The driving scene was placed 1.3 meter from the participant and covered about 50° of the horizontal visual field and 25° of the vertical one. Participants had to drive on a motor way and follow a car while keeping a constant distance (one and a half line on the right side of the road, which means about a 40 m distance). No other road user was present in the road scene except the one the participants had to follow. An orange disk appeared every 3 seconds for 133 ms on the rear window of the lead vehicle. As a central task, participants had to detect when the color of this disk becoming darker. When this change was perceived, participants had to press twice a lever behind the wheel as quickly as possible. We used 12 darker disks, these targets appeared randomly, and the interval between each target was from 19 seconds to 52 seconds. As a second and concomitant task, participants had to detect brief displays (68 ms) of a red signal (of an angular size of 0.2°) which appeared randomly in the road scene. Once perceived, they had to press once a lever behind the wheel as quickly as possible. This peripheral signal could be located at different eccentricities (4°, 8° and 12°; respectively near, middle and distant conditions) in the visual field. Each signal appeared as a combination of the 3 eccentricities and 8 meridians (0°, 45°, 90°, 135°; 180°, 225°, 270° and 315°). Thus, participants had to detect 24 signals (3 eccentricities X 8 meridians). A peripheral signal never appeared at the same time as a critical signal in the central task, a random delay between each peripheral signals was observed (from 7 to 25 seconds). We measured the percentage of correct responses (critical signals detected) for the central task and the percentage of signals correctly detected in the peripheral task according to the 3 eccentricities conditions.

Mood-Induction Procedure

Anger, Sadness and the neutral mood have been induced using the combined Mood Induction Procedure (MIP) developed by Mayer, Allen and Beauregard (1995). This procedure is a combine technique which associates music and guided imagery. According to this MIP, participants first listened to the following pieces of music previously used by Jallais & Gilet (2010) for 4 minutes: Chopin's "Preludes" and Prokofiev's "Alexander Nevsky" to induce sadness; Holst's "the planets" and Moussorgsky' "Night on Bald Mountain" to induce anger. The musical selections used to induce the control group were recorded by Teyssaire (2003) previously used by Corson (2006). Afterwards, the experimenter lowered the sound volume of the music and the participants performed the task of guided imagery during 4 minutes. For that, sentences describing a situation of everyday life congruent with the emotion induced, e.g., "You are told by a young relative that she has cancer and only six months to live", were then displayed on a screen. Participants were asked to imagine as vividly as possible themselves in the situation described. Each sentence (8 sentences in total for each emotion) remained 30 seconds each on the screen. To reinforce the efficiency of the induction, we used a third mood induction procedure to reinforce the induction during the driving task. We developed a modified version of the paradigms presented by Lewis-Evans, et al. (2012) and Gibbons (2009). Three words denoting anger (furious, anger, enraged) or sadness (crying, sorrow, grief) or 3 pseudowords for the neutral mood (jucart, fomcal, bloree) were used according to the experimental group. These words were presented at the same place of the disk and appeared 4 times each for 32 ms (two frames). A masking image appeared just after the words for 150 ms.

Before and after this induction phase, all participants filled in the Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988), which requires a self-report of 16-item mood adjectives on a 7-points scale. This questionnaire allows the evaluation of the valence (mean scores of the adjectives denoting the mood desired, e.g., anger or sadness) and the arousal dimensions. To assess the arousal dimension, the mean scores of adjectives denoting a high/low level of excitation are calculated.

Results

Mood-manipulation check

The valence dimension

We first compared for each group the ratings concerning the adjectives describing the induced mood from the first (before the MIP) to the second administration of the BMIS (after the MIP). The mood manipulation was effective in inducing valence. The Anger group gave higher ratings to the adjectives denoting anger from the first to the second administration of the BMIS, $F(1, 50) = 16.43$, MSE = 0.19, $p<.001$. The sadness group gave higher ratings for the adjectives denoting sadness, $F(1, 50) = 22.18$, MSE = 0.36, $p<.0001$. The ratings given by the control group did not change for each adjective from the first to the second evaluation of the valence, $F<1$.

Comparisons within the second set of BMIS revealed that the groups were in different moods after the induction procedure. The adjectives denoting anger were assigned a higher value by the anger group than by the other mood groups, $F(1, 50) = 6.33$, MSE = 0.39, $p<.01$. Similarly, the Sadness group gave higher ratings to the adjectives denoting sadness than the other groups did, $F(1, 50) = 40.09$, MSE = 0.56, $p<.0001$.

The arousal dimension

The mood induction procedure seems to be effective in influencing arousal. As expected, the arousal scores of the three mood groups differed significantly only after the second evaluation, $F(2, 50) = 4.21$, MSE = 0.21, $p<.05$. The scores given by the Anger group were higher than those given by the Sadness groups, $F(1, 50) = 8.38$, MSE = 0.21, $p<.01$. But the analyses, conducted to compare the sadness and the control groups, did not reveal any differences in the second evaluation of arousal ($F<1$).

Useful visual field

The central task

We analyzed the percentage of correct detections using an ANOVA with Mood (Anger, Sadness and Control) as a between subjects factors. Although the analyzes did not reveal a main effect of Mood ($F(2, 50) = 2.52$, MSE = 138.7, $p< 0.09$). Planned comparisons revealed that participants previously induced in anger detected more critical signals in the central task than the two other groups (Control, $F(1, 50) = 4.11$, MSE = 54.98, $p<.05$; Sadness, $F(1, 50) = 3.52$, MSE = 54.98, $p<.05$. No statistical difference was observed concerning the comparison of the Control and the Sadness groups, $F<1$.

Table 1 Percentage of detections (sd) according to the Central Task and the Mood

	Central
Anger	95.38 (7.12)
Control	90.48 (7.26)
Sadness	90.48 (7.95)

The peripheral task

We analyzed data (see table 1) using a repeated measures ANOVA and a 3 (Mood) X 3 (Condition) mixed model design (see Table 2 for means and standard deviations). Mood (Anger, Sadness, Control) was analyzed as a between subject factor and Condition (near, middle and distant) as within subjects variable. The results revealed a main effect of Mood, $F(2, 50) = 3.01$, MSE = 342.2, $p<.05$, and Condition, $F(2, 100) = 185.09$, MSE = 135.3, $p<.0001$; and an interaction between these two factors (see Figure 1), $F(4, 100) = 2.54$, MSE = 135.3, $p<.05$.

Table 2 Percentage of detections (sd) according to the Conditions and the Mood

	Near	Middle	Distant
Control	83.33 (14.43)	66.07 (14.87)	38.69 (15.26)
Anger	82.35 (15.35)	61.03 (19.20)	40.44 (11.29)
Sadness	80.00 (13.19)	47.50 (9.68)	35.00 (11.76)

Planned comparisons did not show any statistical differences between the Anger and the Control groups along all eccentricities, $F<1$. Data analyses showed that the Sadness group detected less signals in the middle condition than the control and the anger groups (respectively, $F(1, 50) = 12.97$, MSE = 232.65, $p<.001$; $F(1, 50) = 6.26$, MSE = 232.65, $p<.05$). No statistical differences were observed for the other comparisons.

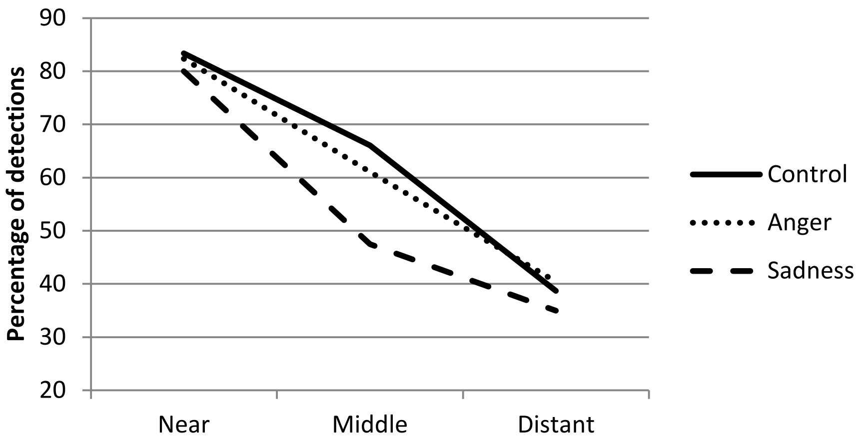

Figure 1 Percentage of detections according to the Conditions and the Mood

Discussion

This research aimed at evaluating the effects of negative moods (anger and sadness) on the drivers' useful visual field and at categorizing these emotions in the taxonomy developed by Regan et al. (2011).

Concerning the effect of anger on the useful visual field, the results presented here could be quite surprising. Indeed, we supposed that the Useful Visual Field (UVF) could be greater in anger. It is not possible to conclude in such way as regards to the lack of statistical differences between the anger and control groups as a function of the peripheral conditions. But, it seemed that anger have nevertheless a positive effect on the useful visual field in the sense that participant induced in this mood have detected more critical signals in the central task than the control group but without decreasing the detection of the peripheral signals. How could this result be explained? Either the anger group had prioritized the processing of the central task, or this group had a greater capability to process information in the central area than the control group.

In our study, all participants were not assigned to prioritize the processing to one of the two tasks in particular. Even if it is not possible to know if the participants gave a priority to the processing of the central task, the results obtained here are not congruent with those demonstrated in the literature concerning prioritization. According to the useful visual field literature, the prioritization of one task should decrease the processing of the other task. Rogé et al. (2002) tested the effect of the priority given to one or another task (central vs peripheral tasks). They revealed that the priority given to the central task processing can decrease the ability to perceive peripheral visual signals during a low vigilance session. In the same way, Williams (1988) but also Chan and Courtney (1994) have demonstrated that the priority given to the central task can lead to a tunnel vision phenomenon. Indeed, a high performance on the central task should have deteriorated the performance on the peripheral task. Interestingly, we did not observe this pattern as the anger group has detected as many peripheral signals as the control group.

Is more attention allocated in the central area during anger? We could easily imagine that the high level of arousal which defines anger can let individuals to process more visual signals or to increase the processing of visual information in the fovea area. According to Fox et al. (2001), the duration and the focusing of attention in arousal situations such as anger are increased. This could explain the anger group's performance in the central task. May be the subliminal stimulation in this group (the use of arousal words) has primed the processing of the central task. Gibbons (2009) showed a priming effect of unconscious words and that to be effective the prime words need to be high on the arousal dimension. The words used for the anger condition met this criterion contrary to those used for the sadness condition. It could be possible that angry drivers only have focused their attention to the central task because of the high arousal priming of the subliminal information displayed. But, even if the participants have focused their attention on the central area because of the presence of a high arousal stimulus in the foveal area, we did not observe any deterioration of the UVF. Now the question we have to point out is to determine if anger really leads to a better processing of information situated in this specific area or if the higher efficiency of this mechanism is due to our methodology.

Further studies have to be developed to discuss this positive effect of anger on the useful visual field. But, if this positive effect is really present, it also true that anger is associated with other behaviors such as risk taking (Deffenbacher et al. 2003, Abdu et al. 2012), or the difficulty to perceive atypical hazards (Stephens & Groeger 2009) which have a major impact on road safety.

Concerning sadness, it seems that this negative emotion interfered with the detection of peripheral signals especially at the 8° eccentricity.

Sadness induces self-focused attention (Frijda 1986, Lazarus, 1991) and ruminations, i.e. repetitive negative irrelevant thoughts that capture attention for a certain period of time and reinforce the negative emotional state (Joorman and Gotlib 2008, McLaughlin et al. 2007; Nolen-Hoeksema 1991, 2000, Nolen-Hoeksema et al. 2008). Therefore, several studies established the negative effects of both sadness and ruminations on information processing and particularly on attention processes (e.g., Huffziger and Kuehner 2009, Watkins and Teadale 2001). In our study, the internal and irrelevant thoughts have certainly decreased the attentional resources available and have therefore decreased the participants' useful visual field. Several studies have already shown the negative effect of sadness on attentional resources (e.g., Lemercier & Cellier 2008). For instance, Pêcher, et al. (2010) assessed the effects of inattention induced by sadness on selective attention processes using the Attention Network Test (Posner, 1980). This test discriminates between three independent attention functions: alerting, orienting and conflict. Their results on reaction times showed that only the orienting function was affected when inattentive, with a significant alteration on spatial information processing. It seems that the inattention provoked by sadness have a negative impact both on the attentional processing and the allocation of these resources but also in the capability to perceive peripheral elements.

Further studies are needed to explore the effects of sadness and anger on the drivers' useful visual field by using more ecological experiments. The opposite effects of these two negative emotions argue the necessity to study these two emotions. Our hypothesis concerning the category in which these emotions take part in the inattention taxonomy (Regan et al. 2011) is enhanced: drivers in anger have sufficient attentional resources, drivers in sadness not. Moreover, the deterioration of the UFV observed in sadness could be defined as a biological factor that can prevent drivers to detect critical information for safe driving. It really seems that anger could be associated with DNA and sadness with DRA, but studies are needed to explore further this hypothesis. These results enlightened the crucial role of emotion on driving and in the comprehension of their relations with inattention.

References

Abdu, R., Shinar, D., and Meiran, N. 2012. Situational (state) anger and driving. *Transportation Research part F*, 15: 575-580.

Ball, K, Beard, B.L., Roenker, D.L., Miller, R. L., and Griggs, D.S. 1988. Age and visual search: expanding the useful field of view. *Journal of the Optical Society of America*, 5: 2210–2219.

Ball, K., and Owsley, C. 1993. The useful field of view test: a new technique for evaluating age related declines in visual function. *Journal of the America Optometric Association*, 64: 71–79.

Bartmann, A., Spijkers, W., and Hess, M. 1991. Street environment driving speed and field of vision, in *Vision in vehicles III* edited by T. G. Gale: North-Holland, Elsevier Science Publishers: 381–389.

Bless, H., Clore, G. L., Schwarz, N., Golisano, V., Rabe, C., and Wolk, M. 1996. Mood and the use of scripts: Does a happy mood really lead to mindlessness? *Journal of Personality and Social Psychology*, 71: 665-679.

Chan, H.S., and Courtney, A.J. 1994. Effects of priority assignment of attentional resources, order of testing and response sequence on tunnel vision. *Perceptual and Motor Skills*, 78: 899-914.

Chopin, F. 1839/1989. Preludes, Opus 28 (2. A Minor). (Time: 1:53). A. Rubinstein (Pianist). New York: RCA Victor Gold Steal (60047-2-RG).

Corson, Y., 2006. Émotions et propagation de l'activation en mémoire sémantique [Emotions and propagation of activation in semantic memory]. Canadian Journal of Experimental Psychology 60, 127-147.

Craft, R.H., and Preslopsky, B. 2009. *Driver Distraction and Inattention in the USA Large Truck and National Motor Vehicle Crash Causation Studies*. Presented at the First International Conference on Driver Distraction and Inattention, Sweden, September 2009.

Crundall, D.E., Underwood, G., & Chapman, P.R. 1997. Peripheral detection rates in drivers, in *Proceedings of the Vision in vehicle VII*. Marseille: Elsevier.

Deffenbacher, J. L., Deffenbacher, D. M., Lynch, R. S., and Richards, T. L. 2003. Anger, aggression and risky behaviour: A comparison of high and low anger drivers. *Behaviour Research and Therapy,* 41: 701-708.

Ellis, H.C., & Ashbrook, P.W. 1988. Resource allocation model of the effects of depressed mood states on memory, in *Affect, Cognition and Social Behavior edited by* K. Fiedler and J. Forgas: Toronto: Hogrefe: 25–43.

Ellis, H.C., and Moore, B.A. 1999. Mood and Memory, in *Handbook of Cognition and Emotion* edited by T. Dalgleish and M. J. Power: Chichester, Englan: John Wiley et Sons: 193–210.

Eysenck M.W., and Calvo M.G. 1992. Anxiety and performance: the processing efficiency theory. *Cognition and Emotion,* 6: 109-434.

Eysenck, M.W., and Calvo, M.G. 1998. Cognitive bias to internal sources of information in anxiety. *International Journal of Psychology,* 33: 287-299.

Feldman, L-A. 1995. Valence focus and arousal focus: Individual differences in the structure of affective experience. *Journal of Personality and Social Psychology,* 69: 153-166.

Fox, E., Russo, R., Bowles, R., and Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety?. *Journal of Experimental Psychology: General* 130: 681–700.

Frijda, N.H. 1986. The Emotions. Cambridge University Press, Cambridge.

Gilet, A-L., and Jallais, C. 2011. Valence, Arousal, and Word Associations. *Cognition and Emotion,* 25: 740-746.

Gibbons, H. 2009. Evaluative priming from subliminal emotional words: Insights from event-related potentials and individual differences related to anxiety. *Consciousness and Cognition,* 18: 383-400.

Holst, G. 1918/1986. The Planets : (Mars, the bringer of war) Time: 6:43). A. Davis (Cond.). The Toronto Symphony. Ontario, Canada: EMI Digital.

Huffziger, S., and Kuehner, C. 2009. Rumination, distraction, and mindful self-focus in depressed patients. *Behaviour Research and Therapy,* 47: 224–230.

Jallais, C., and Gilet, A-L. 2010. Inducing Changes in Arousal and Valence: Comparison of two Mood-Induction Procedures. *Behavior Research Methods,* 42: 318-325.

Joorman, J., and Gotlib, I.H. 2008. Updating the contents of working memory in depression: interference from irrelevant negative material. *Journal of Abnormal Psychology,* 117: 182–192.

Kensinger, E.A., & Schacter, D-L. 2006. Processing emotional pictures and words: Effects of valence and arousal. Cognitive, Affective and Behavioral *Neuroscience,* 6*:* 110-126.

Lazarus, R.S. 1991. Emotion and Adaptation. Oxford University Press, New York.

Lemercier, C., and Cellier, J.M. 2008. Attention deficits in car driving: inattention, distraction, and interference. *Le travail humain,* 71: 271-296.

Lerner, J.S., and Tiedens, L.Z. 2006. Portrait of the angry decision maker: How appraisal tendencies shape anger's influence on cognition. *Journal of Behavioral Decision Making,* 19: 115-137.

Lerner, J.S., Goldberg, J.H., and Tetlock, P.E. 1998). Sober second thought: the effects of accountability, anger and authoritarianism on attributions of responsibility. *Personality and Social Psychology Bulletin, 24*: 563-574.

Lewis-Evans, B., de Waard, D., Jolij, J., & Brookhuis, K. A. (2012). What You May Not See Might Slow You Down Anyway: Masked Images and Driving. PLoS ONE, 7(1), e29857. doi: 10.1371/journal.pone.0029857.

Mackworth, N.H. 1965. Visual noise causes vision tunnel. *Psychonomic Science,* 3: 67–68.

Mayer, J.D., Allen, J., and Beauregard, K., 1995. Mood inductions for four specific moods: A procedure employing guided imagery vignettes with music. *Journal of Mental Imagery,* 19: 133-150.

Mayer, J.D., and Gaschke, Y.N. 1988. The experience and meta-experience of mood. Journal of *Personality and Social Psychology,* 55: 102-111.

McLaughlin, K.A., Borkovec, T.D., and Sibrava, N.J. 2007. The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy,* 38*:* 23–38.

Mueller, J.H. (1992. Anxiety and performance, in *Handbook of Human Performance* edited by A.P. Smith and D.M. Jones: London: Academic: 27–160.

Nolen-Hoeksema, S. 1991. Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology,* 100: 569–582.

Nolen-Hoeksema, S. 2000. The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology,* 109: 504–511.

Nolen-Hoeksema, S., Lyubomirsky, S., and Wisco, B.E. 2008. Rethinking rumination. *Perspectives on Psychological Science,* 3: 400–424.

Pachiaudi, G., Morgillo, F., Deleurence, P., and Guillon, V. 1996. Utilisation du téléphone mains-libres: impact de la communication sur la conduite automobile, approches expérimentales sur simulateur de conduite et en conditions réelles de circulation. (Rep. No 212). Lyon: INRETS.

Pêcher, C., Lemercier, C., and Cellier, J.M., 2009. Emotions drive attention: effects on driver's behaviour. *Safety Science,* 47: 1254-1259.

Posner, M.I. 1980.Orienting of attention. *Quarterly Journal of Experimental Psychology*, 41, 19–45.

Prokofiev, S. 1938/1987. Alexander Nevsky Cantata Opus78 (I. Russia Beneath the Yoke of the Mongols). (Time: 3:42). A. Previn (Cond.). Los Angeles Philharmonic Orchestra Cleveland, OH: TELARC (CD-80143).

Regan, M.A., Hallett, C., and Grodon, C.P. (2011). Driver distraction and driver inattention: Definition, relationship and taxonomy. *Accident Analysis and Prevention*, 43: 1771-1781.

Revelle, W., and Loftus, D.A. 1992. The implications of arousal effects for the study of affect and memory. In *The handbook of emotion and memory: Research and theory* edited by S.-A. Christianson: Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc: 113–149.

Rogé, J. and Pébayle, T. 2009. Deterioration of the useful visual field with ageing during simulated driving in traffic and its possible consequences for road safety, Research in Ergonomic Psychology in the transportation field in France, *Safety Science,* 47: 1271-1276.

Rogé, J., Kielbasa, and L., Muzet, A. 2002. Deformation of the useful visual field with state of vigilance, task priority, and central task complexity. *Perceptual and Motor Skills,* 95: 118-130.

Russell, J.-A. 1980. A Circumplex Model of Affect. *Journal of Personality and Social Psychology,* 39: 1161-1178.

Sanders, A.F. 1970. Some aspects of the selective process in the functional visual field. *Ergonomics,* 13*:* 101–117.

Scialfa, C., Kline, D., and Lyman, B. 1987. Age differences in target identification as a function of retinal location and noise level: examination of the useful field of view. *Psychology and Aging*, 2: 14–19.

Stephens, A.N., Groeger, J.A. 2011. Anger-congruent behavior transfers across driving situations. *Cognition and Emotion,* 25: 1423-1438.

Teysssaire, J.-P., 2003. Obscure clarté, éveil des fleurs et brume. Nature atmosphères. Origins : Hponey-B Publishing.

Watkins, E., and Teadale, E. 2001. Adaptive and maladaptive self-focus in depression. *Journal of Affective Disorders*, 82: 1–8.

Williams, L.J. 1988. Tunnel vision or general interference? Cognitive load and attentional bias are both important. *American Journal of Psychology*, 101: 171-191.