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Body focused repetitive behaviours of drivers in traffic queues: a study of motivational operations

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Abstract

The factors involved in the evocation and maintenance of body focused repetitive behaviours (BFRBs), such as nail biting and nose picking are little understood. Research to date has focused on maintaining factors. One hypothesis is that they are evoked by arousal or stress. Other studies have demonstrated that the presence of other people reduces the frequency of BFRBs. To test this, drivers were observed during morning and evening peak hours. The results showed that BFRBs were more frequent when drivers were alone and less frequent when drivers were conveying a passenger. They were also more frequent in the morning than in the evening. The discussion considers the role of social presence and stress as motivational operations or discriminative stimuli.

Body focused repetitive behaviors of drivers in traffic queues

Repetitive behaviours have been the focus of research in several disciplines. In the health sciences repetitive behaviours are seen as part of a number of pathological states such as trichotillomania (pulling hair out) or stereotyped behaviours in learning disabilities or the rituals of patients afflicted by obsessive compulsive disorder. Interventions for these disorders are increasingly based on an understanding of the variables maintaining their occurrence. Similarly in ethology, certain classes of repetitive behaviour have been studied with a view to understanding motivation and control of behaviour, to the extent that the mechanisms of control have been considered similar in animals and humans (Garner, Meehan and Mench, 2003). In particular repetitive behaviours of captive animals have been often understood as a marker of stress. In this paper we focus on one class of repetitive behaviours: body focused repetitive behaviors (BFRBs) in human beings including nail biting, nose picking and hair manipulation. The behaviours seem similar to those seen in animal grooming e.g. preening in birds, licking or scratching in domestic dogs and cats. Just as excessive grooming in non-humans can lead to injuries, BFRBs may also cause physical damage (e.g. Caruso, Sherry, Rosenbaum et al., 1997; Widmalm, 1995) or have social consequences such as embarrassment or rejection by others (Joubert, 1993; Joubert 1995; Teng, Woods, Twohig and Marcks, 2002). In humans, both psychological and pharmacological interventions for BFRBs have been evaluated, but the former have poor long term success (Adesso & Norberg, 2001) while the latter are poorly tolerated (Leonard, Lenane, Swedo, Rettew, & Rapoport, 1991). In animals too pharmacological agents affecting the serotonergic pathways have been used to reduce repetitive behaviours such as acral lick in dogs. Reviewing the literature in humans, Adesso & Norberg (2001)

considered that more research into the factors that initiate and maintain BFRBs could be useful in identifying more successful interventions.

In human populations most of the research has stemmed from an applied behavior analytic approach which suggests that knowledge of antecedent conditions and consequent events is likely to prove particularly useful in defining effective interventions. Antecedent conditions are described as either having motivational or discriminative properties (termed motivational operations and discriminative stimuli respectively, see Laraway, Snycerski, Michael and Poling 2003). In non-human populations studies of repetitive behaviours have concentrated on understanding the environmental correlates and in inferring emotional states from behaviour.

Antecedents of BFRBs

Observational studies of children have shown that nail biting occurs both when they are bored and in structured situations (Foster, 1998; Troster, 1992; Woods et al., 2001). In an experimental study Teng, Woods, Marcks and Twohig (2004) found that boredom seemed to evoke BFRBs more reliably than anxiety. McGill (1999) draws attention to the literature on developmentally disabled children whose BFRBs (eg self injurious behavior) are commonly evoked by task demands. Indeed a recent study of undergraduates found that although an alone or boredom condition evoked nail biting for most participants, task demand was also a motivational operation for a minority (Williams, Rose and Chisholm, 2006).

The presence of other people may serve as a discriminative stimulus to reduce the incidence of BFRBs as suggested by Joubert (1995) and Williams, Rose and Chisholm, (submitted) for nail

biting. The mechanism reducing nail biting in the presence of others might be avoidance or escape from social negative reinforcement (Woods et al., 2001). Other work suggests hair pulling is negatively evaluated (Woods, Fuqua and Outman, 1999) and might also be subject to negative comments. Nose picking is extremely common (Andrade and Srihari, 2001), but little is known about when it occurs, although anecdotally nose picking is not generally considered acceptable in public.

Consequences of BFRBs

The consequences of BFRBs have not been widely investigated, although further work in this area might lead to better understanding of the possible effects of motivational operations. A significant number of the self injurious behaviors of young children with developmental disabilities seems to be maintained by attention from care-givers (Hall, Oliver and Murphy, 2001), which has led to the development of interventions using non-contingent attention in order to alter the effectiveness of attention contingent on the behavior (see McGill, 1999). Hair pulling in trichotillomania seems to be maintained by a subjective reduction in tension (Christenson and Mansueto, 1999; Miltenberger, Rapp and Long, 2001) and by a sensory quality (Rapp et al. 2000). For undergraduates, nail biting did not seem to be maintained by social interaction (Williams, Rose and Chisholm, 2006). It is tempting to speculate that nose picking serves similar functions to other BFRBs, but there is little evidence to support such an hypothesis.

In summary, BFRBs seem to occur when the participant is stressed, and may be suppressed by the presence of another person. This study was designed to examine these two aspects of the setting conditions for BFRBs in the natural environment. In order to minimise the impact of being observed, the study was carried out by observing drivers in traffic queues in a large town in the South of England. Driving in urban environments particularly when the traffic is moving slowly or

not at all i.e. in traffic queues is often described as stressful (Hennessy & Wiesenthal, 1997). Further more the level of stress varies through the day depending on pressures such as keeping to time (Taylor and Dorn, 2006) which is likely to be worse in the morning than in the evening as is demonstrated by more risky overtaking (Walker, 2006) and more severe accidents (Kim, Kim, Ulfarsson & Porrello, 2006) in the morning than in the evening. Many drivers are accompanied by passengers. Therefore observing drivers with and without passengers in traffic queues both in the morning and the evening offers an opportunity to test the hypothesis that stress and the presence of another person act independently on the incidence of BFRBs, whilst minimising the effect of the observer.

Methods

Observers stationed themselves at a major road intersection in a town in southern England during the morning and evening peak traffic periods on ten weekdays over a three week period. Observers were visible to drivers and were carrying a clipboard. The morning observations started at 8 a.m. and the evening observations started at 5 p.m. All observations were carried out between January and March 2005. Observations continued until 200 drivers with passengers and 200 drivers without passengers had been observed as they passed the observation point during each period. Any Body Focused Repetitive Behavior was noted down using a tally sheet for the most common (nail biting, nose picking and hair manipulation) and writing down less common behaviors. The analysis reported below focuses on nail biting, nose picking and hair manipulation).

Results

A mean of 7.15 (s.d.=3.21) people were observed to bite their nails, 5.55 (s.d. = 3.38) were observed to pick their noses and 7.63 (s.d. = 3.51) were observed to manipulate their hair over the 20 observation periods.

A two by two multivariate analysis of variance was carried out using time of day and presence of others as independent factors. The analysis revealed that there are statistically significant multivariate effects for time of day ($F(3,34) = 14.07$; $p<0.001$) and for presence of other ($F(3,34) = 26.93$; $p<0.001$) but not for the interaction of time of day and presence of other ($F(3,34) = 1.15$; $p=0.35$). Inspection of table 1 shows that the presence of another person and the evening are associated with a lower incidence of BFRBs.

Univariate tests show significant effects of time of day (nail biting $F(1,36) = 8.40$; $p = 0.006$; nose picking $F(1,36) = 19.71$; $p<0.001$; hair pulling $F(1,36)= 15.73$; $p < 0.001$; other $f= 8.91$, d.f. = 1, 36; $P=0.005$) and of the presence of another (nail biting $F = 30.48$; d.f. 1, 36; $p < 0.001$; nose picking $F = 27.80$; d.f. = 1, 36; $p<0.001$; hair pulling $F = 4.96$; d.f. = 1, 36; $p < 0.032$; other $f= 34.00$, d.f. = 1, 36; $p<0.001$) on all three measured BFRBs.

Discussion and Conclusion

As predicted the presence of a passenger reduces the rate of BFRBs displayed by drivers in traffic. The number of BFRBs observed is also less in the evening than in the morning. There is no interaction between time of day and presence of a passenger.

To our knowledge this is the first observational study of body focused repetitive behaviors in drivers. It also provides an initial indication of the antecedents to nose picking (a rarely studied BFRB). The data suggest that driving alone and in the morning independently increase the rate of

BFRBs. The method of observation suggests that the presence of the observer is unlikely to have affected the rate of BFRBs. Therefore we can be reasonably confident that the results are generalisable. However the period of observation of each driver is rather short, thus the estimate of the frequency of occurrence of BFRBs is probably an under-estimate.

The observation methods do not allow us to identify individual drivers so it is possible that the same drivers may have been observed each day. If this were the case a statistical analysis using related sample methods would be required. However the strength of the effects suggests that the same effects would have been found in random samples. A further weakness of the study is that it did not measure driver stress directly, although other studies and a brief survey of office workers in another town suggested that stress was higher in the morning.

Both this and other studies of BFRBs suggest that they are often performed when the participant is alone or under mild stress. For instance, Ellingson, Miltenberger, Stricker et al., (2000) found that finger sucking occurred most often in the alone condition and Williams et al. (2006) showed that nail biting was most frequent in an alone condition, but also occurred in an academic demand condition. Hall, Thorns and Oliver (2003) found similar effects for the effects of presence of others on the frequency of stereotyped behaviours of people with a learning disability. In the non-human literature, studies suggest that animals start to show repetitive self directed behaviour when confined in a low stimulus environment or in the presence of a reinforcer (e.g. food) that they are unable to access despite the motivation to do so (Duncan and Wood-Gush, 1972). The presence of another person modifies the environment considerably and almost certainly makes it more stimulating. However the effect of the presence of conspecifics can increase the rate of stereotyped behaviours (e.g Spinu, Benveneste & Degen, 2003) as well as decrease them as in our

study. Our results have added to this literature in suggesting that stress and lack of company act independently to increase the rate of BFRBs in adult humans.

The results of this study are similar to those seen in studies of stereotyped behaviours in non-human animal populations. Recently Cleaveland, Jäger, Rößner and Delius (2003) described the effect of delay of reinforcement on behaviour in pigeons and budgerigars, finding that repetitive seemingly irrelevant behaviours occur during the interval between stimulus presentation and reward arrival. They speculate that the behaviours are part of a general stress response system, the elements of which are under some environmental controls. In this study one such environmental variable (presence of another) was found to suppress stereotyped behaviours in the presence of a frustrating stimulus (traffic queue).

It seems that the presence of others serves to reduce the occurrence of BFRBs while driving in the morning increases them. The lack of an interaction effect suggests that two independent mechanisms may be operating. This begs the question of how these two variables operate to change the frequency of BFRBs. To answer this question we return to the ideas noted in the introduction. Broadly, previous writers have suggested that setting conditions can operate as either discriminative stimuli (signalling a change in the availability of reinforcement) or as motivational operations (a change in the value of the reinforcement). It is difficult to envisage how time of day signals a change in availability of reinforcement for a BFRB, however time of day might operate as an motivational operation through increased stress levels in the morning and decreased stress levels in the evening. Emotional or arousal state is likely to act to change the value of a reinforcer (cf. effects of buprenorphine on the reinforcement value of other opiates - Mello, Mendelson and Kuehnle, 1982). One might speculate that the maintaining factor for all three BFRBs observed in this study would

therefore be negative automatic reinforcement i.e. a feeling of relief following performance of the BFRB).

The presence of another might signal an increased likelihood of punishment (e.g. by negative social interaction). The presence of another could also alter the reinforcing properties of the BFRB by providing alternative non-contingent positive reinforcers (e.g. social interaction) thus reducing stress. Thus the presence of another might act as a discriminative stimulus and/or a motivational operation. In order to establish its function it would be necessary to determine which consequences it was associated with. The available evidence suggests that BFRBs are negatively evaluated by others, and that people who engage in BFRBs are likely to be less well evaluated than people who do not engage in BFRBs (Woods, Fuqua & Outman, 1999).

We would, therefore, suggest that increased stress leads to a state in which BFRBs have a greater reinforcement value. This could be tested by comparing the incidence of BFRBs under induced stresses with conditions under which stress was low. However a straightforward experiment, in which participants are aware that they are being observed, is likely to suppress the incidence of BFRBs.

An alternative explanatory framework has been proposed by ethologists following the work of McFarland and Sibly (1974). In essence this proposes that the decision about which behaviour to engage in is dependent on its value to the genes carried by the animal. Early attempts to describe the mechanisms used a state dependent mechanism (eg hunger) to determine the choice of behaviour. More recently, Grafen (2002) has proposed a state independent model which could be used to explain behaviour choices.

References

Adesso, V. J., & Norberg, M. M. (2001). Behavioral interventions for Oral-Digital habits. In D. W. Woods & R. G. Miltenberger (Eds.), *Tic disorders, trichotillomania, and other repetitive behavior disorders: behavioral approaches to analysis and treatment* (pp. 223-240). Boston, USA: Kluwer.

Andrade, C., & Srihari, B. S. (2001). A preliminary survey of rhinotillexomania in an adolescent sample. *Journal of Clinical Psychiatry, 62*, 426-431.

Caruso, R. D., Sherry, R. G., Rosenbaum, A. E., Joy, S. E., Chang, J. K., & Sanford, D. M. (1997). Self-induced ethmoidectomy from rhinotillexomania. *American Journal of Neuroradiology*, *18*, 1949-1950.

Christenson, G. A. and Mansueto, C. S. (1999). Trichotillomania: Descriptive characteristics and phenomenology. In M. B. Stein, G. A. Christenson and E. Hollander (Eds.). *Trichotillomania.*(pp 1-41). Washington, D.C., USA: American Psychiatric Press

Christenson, G. A., Ristvedt, S. L., & Mackenzie, T. B. (1993). Identification of trichotillomania cue profiles. *Behaviour Research and Therapy, 31,* 315-320.

Cleaveland, J. M., Jäger, R., Rößner, P., & Delius, J. D. (2003). Ontogeny has a phylogeny: background to adjunctive behaviors in pigeons and budgerigars. *Behavioural Processes, 61*, 143-158.

Ellingson, S. A., Miltenberger, R. G., Stricker, J. M., Garlinghouse, M. A., Roberts, J., Galensky, T. L., & Rapp, J. T. (2000). Analysis and treatment of finger sucking. *Journal of Applied Behavior Analysis, 33*, 41-52.

Garner, J. P., Meehan, C. L., & Mench, J. A. (2003). Stereotypies in caged parrots, schizophrenia and autism: evidence for a common mechanism. *Behavioural Brain Research, 145,* 125-134.

Hall, S., Thorns, T., & Oliver, C. (2003). Structural and environmental characteristics of stereotyped behaviors. *American Journal on Mental Retardation, 108*, 391-402.

Hall, S., Oliver, C., & Murphy, G. (2001). Early development of self-injurious behavior: An empirical study. *American Journal on Mental Retardation, 106*, 189-199.

Hennessy, D. A., & Wiesenthal, D. L. (1997). The relationship between traffic congestion, driver stress and direct versus indirect coping behaviours. *Ergonomics, 40*, 348-361.

Joubert, C. E. (1993). Relationship of Self-Esteem, Manifest Anxiety, and Obsessive-Compulsiveness to Personal Habits. *Psychological Reports, 73*, 579-583.

Joubert, C. E. (1995). Associations of Social Personality-Factors with Personal Habits. *Psychological Reports, 76*, 1315-1321.

Kim, J.-K., Kim, S., Ullfarsson, G. F., & Porrello, L. A. (2006). Bicyclist injury severities in bicycle-motor vehicle accidents. Accident analysis and prevention, doi:10.1016/j.aap.2006.1007.1002.

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terems to describe them. *Journal of Applied Behavior Analysis, 36*, 407-414.

Leonard, H. L., Lenane, M. C., Swedo, S. E., Rettew, D. C., & Rapoport, J. L. (1991). A Double-Blind Comparison of Clomipramine and Desipramine Treatment of Severe Onychophagia (Nail Biting). *Archives of General Psychiatry, 48*, 821-827.

Mello, N. K., Mendelson, J. H., & Kuehnle, J. C. (1982). Buprenorphine effects on human heroin self-administration: an operant analysis. *Journal of Pharmacology and Experimental Therapeutics, 223,* 30-39.

Miltenberger, R. G., Rapp, J. T., & Long, E. S. (2001). Habit reversal treatment manual for trichotillomania. In D. W. Woods & R. G. Miltenberger (Eds.), Tic Disorders, Trichotillomania and Other Repetitive Behavior Disorders: Behavioral Approaches to Analysis and Treatment (pp. 170-195). Boston: Kluwer Academic.

Rapp, J. T., Miltenberger, R. G., Galensky, T. L., Ellingson, S. A., Stricker, J., Garlinghouse, M., & Long, E. S. (2000). Treatment of hair pulling and hair manipulation maintained by digital-tactile stimulation. *Behavior Therapy, 31*, 381-393.

Taylor, A.H., and Dorn, L. (2006). Stress, Fatigue, Health and Risk of road traffic accidents: the contribution of physical inactivity. *Annual Review of Public Health, 27*, 371-391

Teng, E. J., Woods, D. W., Twohig, M. P., & Marcks, B. A. (2002). Body-focused repetitive behavior problems - Prevalence in a nonreferred population and differences in perceived somatic activity. *Behavior Modification, 26*, 340-360.

Walker, I. (2006, 30 September 2006). Time of day effects in drivers overtaking of bicycles. Retrieved 22 February, 2007, from the World Wide Web: www.philica.com/display_article.php?article_id=24

Widmalm, S. E., Christiansen, R. L., & Gunn, S. M. (1995). Oral Parafunctions as Temporomandibular Disorder Risk-Factors in Children. *Cranio-the Journal of Craniomandibular Practice, 13*, 242-246.

Williams, T.I., Rose, R. and Chisholm, S. (2006) What is the function of nail biting: an analog assessment study. *Behaviour Research and Therapy 45*, 989-995

Woods, D. W., & Miltenberger, R. G. (1996). Are persons with nervous habits nervous? A preliminary examination of habit function in a nonreferred population. *Journal of Applied Behavior Analysis, 29*, 259-261.

Woods, D. W., Fuqua, R. W., & Outman, R. C. (1999). Evaluating the Social Acceptability of Persons with Habit Disorders: The Effects of Topography, Frequency, and Gender Manipulation. *Journal of Pschopathology and Behavioral Assessment, 21*, 1-18.

Woods, D. W., Fuqua, R. W., Siah, A., Murray, L. K., Welch, M., Blackman, E., & Seif, T. (2001). Understanding habits: A preliminary investigation of nail biting function in children. Education & Treatment of Children, 24(2), 199-221

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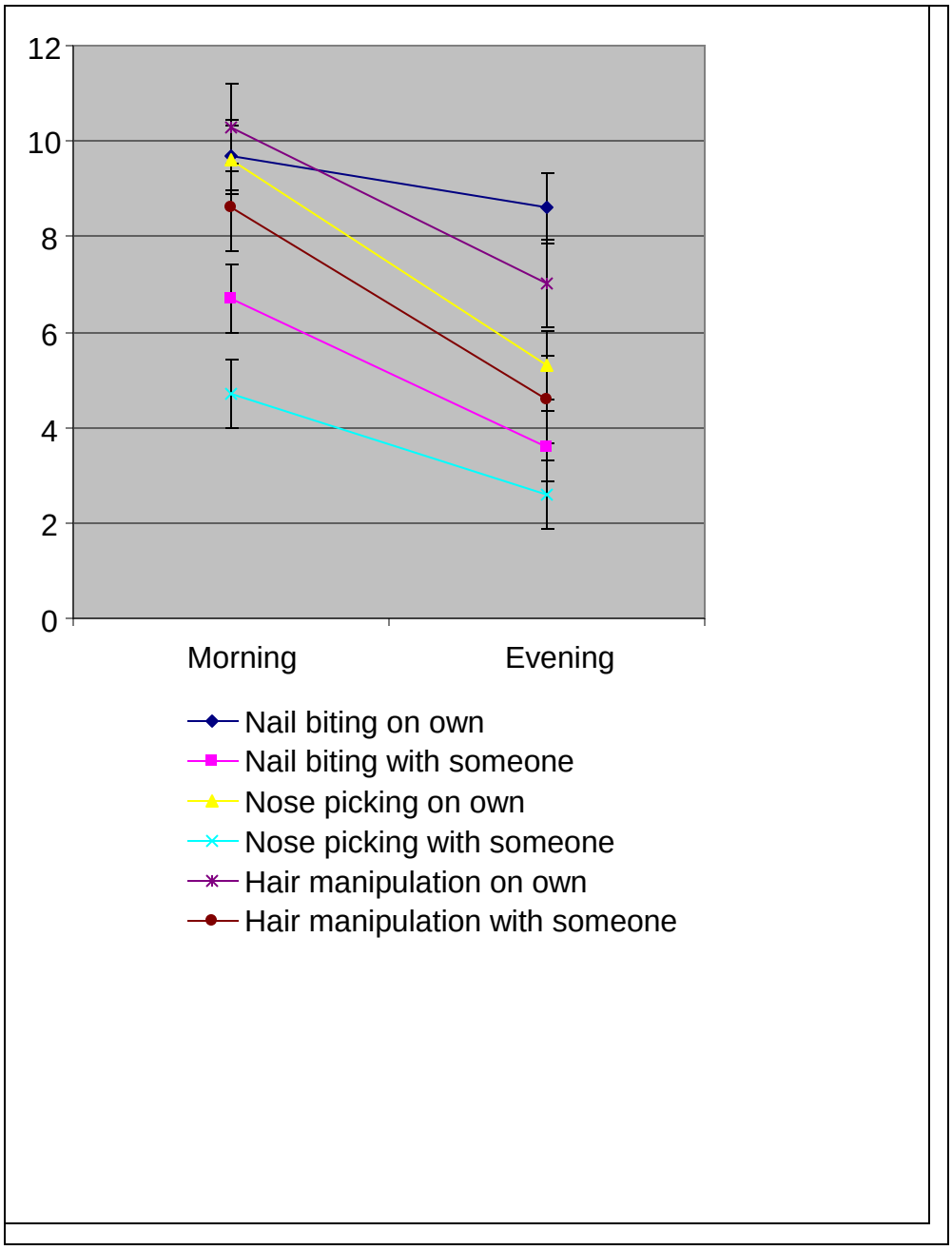
Table 1

Body focused repetitive behaviours of drivers observed in traffic queues in the morning and evening peak hour

Behaviour	Time of day	Alone	With someone
Nail biting	Morning	9.7 (0.73)	6.7 (0.73)
	Evening	8.6 (0.73)	3.6 (0.73)
Nose picking	Morning	9.6 (0.72)	4.7 (0.72)
	Evening	5.3 (0.72)	2.6 (0.72)
Hair pulling	Morning	10.3 (0.92)	8.6 (0.92)
	Evening	7.0 (0.92)	4.6 (0.92)
Other	Morning	4.3	1.6
	Evening	2.6	1.2

Figure Captions

Figure 1. Number of BFRBs observed in morning and evening peak traffic periods


12
10
8
6
4
2
0
Morning
Evening
Nail biting on own
Nail biting with someone
Nose picking on own
Nose picking with someone
Hair manipulation on own
Hair manipulation with someone